73 magazine
for radio amateurs

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A product in the amateur market gets a reputation very quickly. It measures up to what you expect in engineering, performance and quality —or else. That's why A/S amateur antennas are built to the identical design and construction standards as their commercial counterparts. Standards that have made them specified for more police and public safety vehicle installations than all other brands combined.

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High performance ⅝ wavelength design for the new 220 MHz activity! Directly fed with low loss coil in new low-profile design. Spring and whip easily removable leaving only 1 3/16" high base for car wash clearance. 3 dB gain.*

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73 magazine
for radio amateurs

#159 DECEMBER 1973

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This month a crowd gathers to witness the sailing of the Spanish Armada.

Cover girl Linda is 22, single, native Floridian, college grad, loves horseback riding and works as a school teacher, legislative assistant and models for W4PPC, who took the cover picture. George is president of George Singer Creative Services on Key Biscayne. Linda's measurements are 89-58-91 (cm). . .kinda makes you want to go metric, doesn't it? Poster available: A full color 11x14 enlargement of this lovely cover picture, without that obstructing package, is available from 73 Magazine, Peterborough NH 03458, for $3. Now there's a way to dress up the shack!

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Amateur Radio

DECEMBER MCMLXXIII Monthly Ham

AMATEUR AIDS RABIES VICTIMS

A mother and daughter were saved from the dreaded ravages of the rabies disease by the alert action of Jim Brooks KG4FU of the U.S. Naval Base at Guantanamo Bay, Cuba.

The story began during the morning hours of 3 October 1973 when Jim received a call from Cesar HP4CK of Changuinola, Panama to help in relaying an urgent medical message into Ghana, Africa.

According to the message from Cesar, the wife and daughter of Mauro Chattaneo from Tema, Ghana had been bitten by a dog while visiting South America. Ten days later the dog was found to be rabid.

Jim, fearing that time was critical and suspecting that propagation into Africa would be difficult, drafted a message to the American Embassy in Ghana and sent the message on circuits outside of the amateur bands informing them of the situation.

A message was later received from the embassy informing Jim that the Cattaneo family had begun appropriate medical treatment.

CLEGG UPDATES 220 REPEATER LEASING PROGRAM

In its continuing efforts to bring 220 MHz activity to radio amateurs from coast to coast, Clegg is now offering two lease options and one option to purchase its Model 106 self-contained, 220 MHz repeater with duplexer.

Clubs may lease the 220 MHz repeater at a monthly rental of $25.00 for 3 years with the purchase of 12 FM-21 220 MHz transceivers. Clubs will then have the right to fully pruchase the repeater at $500 at the end of the first year, at $300 after the second year, and at $100 at the end of the third year. Or secondly, a club may lease the repeater at a monthly rental of only $15 for 3 years with the purchase of 35 FM-21 transceivers.

Clubs would then have full purchase rights at $500 at the conclusion of the first year, at $300 after the second year, and at $100 at the end of 3 years.

The third option available simply enables clubs to buy the repeater for $1,000 with the purchase of 12 or more FM-21 sets.

The repeater is leased complete (except antennae and feed line) with features that include automatic identification, all solid-state construction, and built-in timers. It operates at 10 to 15 watts, uses a Phelps-Dodge duplexer, and has approximately .4μ V sensitivity. It includes an ac supply, local MIC, and metered signal strength.

All amateur radio clubs are invited to contact the Clegg Division or any Clegg Dealer if interested in joining or finding out more about the updated Clegg repeater program. Or, they may write Carl Jacobson, National Sales Manager, Clegg Division, International Signal and Control Corporation, 3050 Hempland Road, Lancaster PA 17601, or telephone him at (717)299-3671.

Here is a photograph of the 3cm mobile amateur rig presently being operated by WA4WDL. It has receivers for 10cm and 3cm along with a solid state transmitter for 3cm. It has a doppler radar system for anti-collission research and has the capability of legally confusing police radar units!

MINIATURE LICENSE COPIES

In an effort to encourage people to get the AMATEUR EXTRA CLASS license and to reqard those who have gone to the trouble to get the license, a Chicago organization has decided to give free, without any charge, an exact photostatic miniature wallet of an Amateur Extra license to those sending in their original.

Upon receipt of the original, the duplicate will be made and returned along with the unharmed original within about a week. It is asked only that a self-addressed stamped envelope be included for return of the original and the wallet duplicate.

Amateur Extras *only* should send their license and self addressed envelope to: *DUPLICATE — Amateur Extra 1701 W. Devon, Box 60045, Chicago IL 60660.*

News Pages

Twenty-nine more amateurs licensed in Jordan! Twenty-three boys and six girls have passed the one hundred hour study course and gotten their amateur licenses. The call for the club station is JY6AC keep an ear peeled for them.

JORDAN'S TOURIST AND VISITOR CALLS

JY Call	Home Call	Name
JY8AA	W2NDS/1	Wayne Green
JY8AP	DJ0AP	Majdi Kurdiah
JY8BI	DK2BI	Joachim Immelnkempe
JY8JK	G3KP	John Ray Killeen
JY8MBB	MP4MBB	John Murdoch Cooper
JY9AA	WA3HUP	Mary Ann Crider
JY9AB	W3GE	Charles Crider
JY9AC	EP2JH-XYL	Karla Holmes
JY9AL	9K2AL	Mohamad Z. Ageel
JY9AM	9K2AM	Johamad S. Bahbahani
JY9BB	W4TA	Bruce B. Blackburn
JY9DB	WA2ADB	William C. Blackley
JY9DC	WB6CYZ	Gerald Holmes
JY9DK	WA6FSC	Darleen A. Souligny
JY9DX	WA5VKJ	Richard Harris
JY9FB	EP2FB	William Frisbie
JY9FI	OD5FI	Rachid Edriss
JY9FOC	G3FNF	Raymond Hargreaves
JY9GR	DJ9GR	Ruediger Geissler
JY9HF	7Z3AB	Henry Folkerts
JY9HM	FL8HM	Hassan Ahmad
JY9KS	WA2KBZ	Karl Shulte
JY9MA	SU1MA	Abdul Moety Attiya
JY9PP	DJ9PP	Karl Bauer
JY9SA	ST2SA	Dr. Sid Ibrahim
JY9VO	WA6OPJ	George Murray
JY9WB	EP2WB	Wolfgang Bauer
JY9XL	FG7XL	J. Pierre Tendron
JY9YL	EP2YL	Roselyn Frisbie

U.S. AMATEUR FREQUENCY ALLOCATIONS

	CW Only	Phone & CW
Extra Class	3.500– 3.775	3.775– 4.000
	7.000– 7.150	7.150– 7.300
	14.000–14.200	14.200–14.350
	21.000–21.250	21.250–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
Advanced Class	3.525– 3.775	3.800– 4.000
	7.025– 7.150	7.150– 7.300
	14.025–14.200	14.200–14.350
	21.025–21.250	21.270–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
General Class	3.525– 3.775	3.890– 4.000
	7.025– 7.150	7.225– 7.300
	14.025–14.200	14.275–14.350
	21.025–21.250	21.350–21.450
	28.000–28.500	28.500–29.700
		50.100–54.000
Novice Class	3.700– 3.750	
	7.100– 7.150	
	21.100–21.200	
	28.100–28.200	
Technician Class	50.100 – 54.000, 145.000 – 148.000, 220 MHz band and above.	

SSTV Frequencies

	Suggested
3.775– 3.890	3.845
7.150– 7.225	7.220
14.200–14.275	14.230
21.250–21.350	21.340
28.500–29.700	28.680
50.100– 54.000	

LICENSE FEES

Initial License	$ 9
Renewal	$ 9
New Class	$ 9
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Special Call Sign	$25

Use FCC Form 610 and mail with appropriate fee to:

Federal Communications Commission
Gettysburg PA 17325

RECIPROCAL LICENSING Between U.S. and: CE - CP - CT1 - CX - D - EI - F - G - HB9 - HC - HI - HK - HP - HR - LA - LX - OA - OH - PA - PY - SM - TG - TI - VE - VR2 - VU - YB - YN - YS - YV - ZL - ZP - 3A - 4X - 6Y - 8P - 9K - 9L - 9Y.

THIRD PARTY AGREEMENTS Between U.S. and: CE - CM - CO - CP - CX - EL - HC - HH - HI - HK - HR - JY - LU - OA - PY - TG - TI - VE - VO - XE - XP - YN - YS - YV - ZP - 4X - 4Z - 8R - 9Y. Also W/K/8P.

RESTRICTED COUNTRIES (don't work) are now down to only Vietnam(s) 3W8 and XV, with the exception of XV5AC being okay.

EDITORIAL BY WAYNE GREEN

PR TO CONGRESS

It may be of interest to amateurs who want to help their hobby that most, if not all, of the recent repeater licenses granted by the FCC have been as a result of congressional prodding. A call from a Representative or a Senator seems to break through the Walker quagmire of paperwork and red tape, where nothing else does.

One result of this mess is that there are now few members of congress who are not a little more familiar with amateur radio than they were a year ago. We want them to be even more familiar because we may need their help in getting the Walkerules repealed. To this end we here at 73 have prepared a short paper which explains what amateur radio is, what repeaters are, what our basic problems are, and how congressmen can help. Please send a sase to 73 Magazine, Peterborough NH 03458 and ask for the Congress Paper (two sheets). Send this to your senator or representative with a note asking him to help.

RADIO AMATEURS PLEAD FOR HELP!

WHY AMATEURS NEED HELP

The recent devestating fire in Chelsea (Boston) brought out a problem that needs some thought. Virtually all of the communications for the fire were carried on over two meter repeaters, with more than one hundred local amateurs participating. This is the stuff that we need to feed to the news media and to congress.

So what happened? The only story written about the event was sent to ARRL where, presumably, it will eventually end up in QST. Okay, so amateurs will know how great amateur radio is – but congress won't. The fact is that *only* 73 sends copies of its newspages to congress. Right now we need that PR with congress a lot more than we need it for self–congratulation. If you or your club gets involved in anything which reflects to the benefit of amateur radio, please see that it is written up – pictures taken – and send it to 73 Magazine. This goes for small services as well as large – saving one life or thousands.

By the way, the CBers tried to jam in around the Chelsea holocast, but had to be chased away since they had no clear channels and no discipline. By a curious quirk, all of the National Guard radios were out being serviced, so even they had to depend upon our repeaters.

Let's not continue to hide our light under a bushel – and let's stop depending on QST for PR – only 73 is doing amateur PR with congress.

EMERGING NATIONS

The future of our short wave and UHF bands lies more with the ITU than anything else, the current 224 MHz CB proposal notwithstanding. This, in turn, means that the very existance of amateur radio in the future depends upon the value placed on it by the governments of the African and Asian countries – the so-called emerging nations.

Is anything much being done today to prepare for the inevitable ITU conference scheduled for the 1970's? The answer, unfortunately, is that very, very little is being done.

One of the keys to getting support from these countries is to get them involved with amateur radio. The hobby has enormous benefits for any country, if only the leaders knew about it. The problem is, then, how do we get the word to them?

While not all of us know the leader of a country personally, there are more amateurs than you might think that do get to talk with them now and then – one approach would be to make sure that no such opportunity is missed. If you talk with an amateur who has such a connection, make sure that he realizes the importance of trying to get amateur radio developed in the country.

In order to help this project, we have prepared a paper which explains the benefits of amateur radio to emerging nations, ending with the example of Jordan and the developments there. Copies of the paper may be had by sending a sase to 73 Magazine, Peterborough NH 03458 and asking for the "Key to Communications" paper.

the Key to Growth
COMMUNICATIONS

If you even know an amateur who may be visiting a small country and who might be able to get to see the president or king, see if you can have a copy of our paper in his hand when he leaves. You might also ask amateurs in the rarer countries if such a paper could be gotten to an appropriate level if you sent one over. Let's get to work on this and start laying the foundation for the continuance of amateur radio into the 80's. You might also be responsible for hundreds or even thousands of new hams sprouting up in some corner of the world, thus having a lasting effect on their lives and the future of their country.

POSITIONS OPENING

As 73 Magazine continues to grow, there are more positions opening on the staff. The work is fun and the work atmosphere perhaps a little more relaxed than it ought to be – and there is no finer place to live in the country than New Hampshire – an area famous for vacationing four seasons of the year.

Our needs are changing constantly, but at present we are looking for help in editing, circulation and advertising sales. Salaries are generally in the $6000 to $9000 range, but his depends upon experience. Some writing or photography experience will be helpful, and the more ham experience the better.

Continued on page 17...

MAXIMIZE YOUR AMATEUR RADIO MONEY.

What new 2M FM gives me most for my money, performance vs. price? The answer's as clear as the superb reception you'll get on the new Standard 826MA, 10 watt, 2 meter FM transceiver. You'll find such outstanding features as 12 channels — with the four most popular ones included — and a RF output meter with selection of 10 watts or 0.8 watt for battery conservation. And of course, our "Astropoint" system that assures: top selectivity, great sensitivity, and rejection of unwanted signals on today's active 2M band. **Helical Resonators** & FET front end provide the performance needed for tomorrows crowded channels. Provision for **tone coded squelch** to activate modern repeaters. A radio that won't become obsolete. Occupies less than 200 cu. in. Weighs less than 5 lbs. It has all the same "Astropoints" as entire Amateur line.

NEW 22 CHANNEL BASE STATION
SRC-14U

Ultimate in a 2M FM Transceiver features:

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- ☐ Receiver offset tuning
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- ☐ Three Front Panel Meters
- ☐ Plus many more exciting features.

For detailed information on these; the complete Standard line and the name of your nearest dealer write:

Standard
Communications Corp.
213 / 775-6284 · 639 North Marine Avenue, Wilmington, California 90744

SSTV SCENE

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

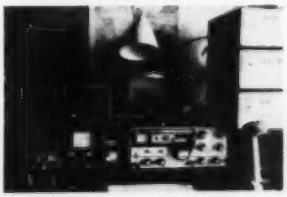
The Slow Scan Program Contest which we announced in October to run through December 31, 1973 is in full swing and progressing quite well. There's no "wallpaper" being awarded, but I'm sure you could find a prominent place for that gear, eh? Recapping briefly, this is a contest for the best SSTV program received. (Use 1 7/8 ips cassettes. . .6 minute maximum time limit on program.) Entries will be judged on originality of the SSTV program, with technical aspects counting in the scoring. If you haven't sent in your entry yet, do get busy and give it a try – turn that skill and ingenuity into some SSTV gear. Be sure to include return postage for the cassette and get it in the mail to 73 Magazine, Peterborough, New Hampshire 03458 so we will receive it by December 31. Results will be announced in this column and maybe on the SSTV net the first of January.

VK9XX of Christmas Island and KG6KA of Guam are now active on 20 meter Slow Scan, and VK9DJ on Papua is set to go except for a crt, which he should have by the time you read this. 3D2AZ and 3D2BJ on Fiji have the "SSTV bug" (thanks to some help from Barry, VK5BS) and we hope to get them going, even if on loaned gear. I understand Fiji is a real paradise and natives there don't get in a big hurry over life, (Gad! Do places like that still exist?) so it may be a few months yet. . .Down Australia way, VK6ES now has a vicicon camera going, and VK7CD has finished his WØLMD Monitor, while some of the other VKs are now starting construction of a WØLMD unit. They also report growing JA Slow Scan activity as does Bob WA7QBV, who passed along this month's photo he received from JAØBZC. Fine looking gear.

I often receive inquiries from Slow Scan newcomers about the various SSTV nets, and their operating procedure. There are 3 basic world wide nets: the U.S. Net, which meets on 14.230 khz at 1800 gmt every Saturday, the Australian SSTV Net, which meets on 14.230 khz at 0100 gmt Sundays, and the Canadian SSTV Net, which meets on 14.180 khz at 2100 gmt Sundays. All three nets use relatively the same procedure, so I will exemplify the U.S. Net. A specific area is called for, (like Eastern United States, or Western United States area) and you call in with a short call on SSB only. The net control will acknowledge each station, then, in turn, call for each to transmit. Your transmission should begin on SSB with the usual name, QTH bit followed by any questions, request or items of interest you have. Then a brief Slow Scan TV transmission from you and back to net control. (Remember this is an example only, not a sterotyped form.) Should you, during the course of the net, hear something or someone of interest, there is a time you can call back in. Usually the net control makes this obvious with something like "any comments on the previous transmission by. . ." Often conversations on or near the net become quite technically involved, and much information (and new ideas!) is exchanged. Here you must remember Slow Scan is the newest and most sophisticated mode today and advancements are happening so fast often even the magazines can't keep abreast. In fact, most of the net controls are set up for I.S.B. and I suspect we will soon see more of this on the net also.

While on the subject of newcomers, here's a couple of "Rambling thoughts" worth mentioning. . .SSB DXers can usually spot DX by the wavering audio and speech accent. Slow Scan TV DX (which syncs from 50 Hertz lines) is obvious to the ear because their sync pulses are running slightly faster, and while viewed on the screen their pictures are not as wide. The next time you see DX pictures, make a mental note of these points, compare them with U.S. pictures (60hz line frequency) and you'll see what I mean.

A while back, I mentioned the fact various P7 crts had different degrees of persistance (some far too short for Slow Scan TV) and, as a result, many of the fellows considered using only RCA tubes as an alternative. But what about those "hamfest specials" one invariably runs into? One quick way you could check their persistance is to hold a quick-made transparency (sketch on cellophane paper with a felt pen) over the screen, expose to the sunlight a second or two, remove the slide, then view iin a dark area, or cover crt face with hands, etc. Make sure your eyes are accustomed to dim light while checking the persistance. In a pinch, you could just lay a couple of fingers on the crt face for the "slide" effect. A good P7 crt will hold an image like this the same as if it were a regular Slow Scan picture.



Shack layout of JAØBZC. The SSTV gear at the left and all the other equipment besides the FT–200 is homebrew.

Finally, Franco I1LCF and CQ Elettronica of Italy are presently conducting two contests: one for the best quality pictures exchanged over the air on SSTV and the other for the longest distance covered by SSTV. Send photos and/or tapes to Franco, I1LCF. Sorry, I don't know the deadline or prizes yet.

50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

WB2LGD says August was poor except for the 10th, worked Alabama, Florida, Mississippi, Ohio and California from 13/30 to 17/30Z. Bob and Mike W2FND attended the East Coast VHF Society antenna measuring contest in Trenton, N.J., returned to Mike's QTH and worked 8P6EN. Bob went to his home, turned on the rig and worked WA7FSI/7 in Idaho. . .and is still wondering what he missed.

WA1EXN notes 6 days of skip in August, September contest poor until Aurora at 1900Z. Worked 2–3–4–8–9–VE2–3 on SSB until 2300Z, then worked another hour on CW after SSB faded. Art's comment on SB–110 noise limiter capacitor change (to 200pf) "all I can say is beautiful." Art also says a 12GN7A makes a good substitute for 12BY7s. No more output but a lot more stable and lasts a lot longer.

WØYZS told me at the Central States VHF conference in Bloomington, Minnesota that he expected to have the antenna back up within 2 months – have not heard him yet. Andy VE4MA is moving to VE6 with his 50MHz gear, son Barry will remain active as VE4MA but only on the higher frequencies. It was a pleasure to meet W7JRG and W7VDZ after years of talking to them, also enjoyed several hours conversation with KØLCB, K5WVX and K5BXG while mobiling from Minneapolis into Iowa. WØPFP commented that we had not talked on the air for several years so we made up for lost time in the Marriott bar and managed some fur-

ther comments via Aurora during the contest.

Mac WØGNS attended to lend an air of respectability to the proceedings as did KØRIR, WA7FPO and W1HDQ. Ed presented a slide program featuring the VHF triumphs of the 40's and 50's. Dick K2RIW presented a most interesting talk on external anode amplifier design, while Mel W2BOC treated us to the fruits of his labors in documenting Es over the past several decades. Hoppy WB4BND was in attendance wearing a "73" button and chewing his ever present seegar. Hope to see you in Colorado next August.

I attended a meeting of the Amateur Radio Technical Society of St. Louis last spring during which it was suggested that perhaps readers of this column would be interested in a ground plane designed and used by club members. By minor adjustment of dimensions this antenna could be used in the SSB, AM and FM portions of the band and best of all, the parts are inexpensive and readily available.

WAØ ABI

Tom DiBiase WB8KZD
708 6th Avenue
Steubenville OH 43952

CONTESTS

DEC 1–3	**Delaware QSO Party**
DEC 15–16	**EA (Spanish) Contest CW**
FEB 9–10	**Ten–Ten International Net Contest**

THIS MONTH
Delaware QSO Party

From 0000Z DEC 1 to 0000Z DEC 3. Stations may be worked only once per band regardless of mode. Exchange QSO nr., RS/T and QTH (DE county or state/province/country.) Freqs.: 3560, 7060, 14060, 21060, 28160, 3975, 7275, 14325, 28650, 50.4, 145.2, 21120, 28160. DE stns. score 1pt. per QSO and multiply by nr. states/provs./cntrys. Non-DE stns. score 5pts. per DE QSO and multiply by 1 for 1 DE county, by 3 for 2 Counties, and by 5 for 3 counties (New Castle, Kent, and Susses). Appropriate awards. Mail logs with SASE if award & results desired to John R. Low K3YHR before JAN 15, 1973. ADR is 11 Scottfield Drive, Newark DE 19711.

EA (Spanish) Contest CW

From DEC 15 at 2000Z to DEC 16 at 2000Z. Send six digit QSO and RST combination (eg. 599001, 579002 etc.). US stns. score 2 pts. per QSO with EA District stns. US stns. multiply total QSO pts. from each band by total EA Districts worked from each band. Logs should include dates, times, bands, stations worked, exchanges sent & recieved, QSO pts. and new mulitpliers. A summary sheet is also required with point info & declaration etc. These must be received by JAN 16 and the ADR is URE 1973 International Contest, P.O. Box 220, Madrid, Spain. If you can read Spanish better than I can, write them for complete details.

WB8KZD

Bill Pasternak WA2HVK/6
14732 Blythe Street #17
Panorama City CA

What has become of Larry? You know, "CB Larry", the menace of New Mexico. Larry is the heaxter who popped up on 11 meters one day yelling for help. He claimed he was trapped in an overturned vehicle some place in the Monzano Mountains southeast of Albuquerque. Immediately, some 200 rescuers and 22 search planes were organized and a thorough search of the area was begun. As reported in Newsweek of September 10, 1973 (Page 53, titled "Blabbermouths") the search lasted five days but failed to turn up any trace of the distress caller. The network media covered the event from start to finsih while the country waited for word of a rescue. It was a hoax! An expensive hoax if you consider what the rescue effort probably cost the taxpayer.

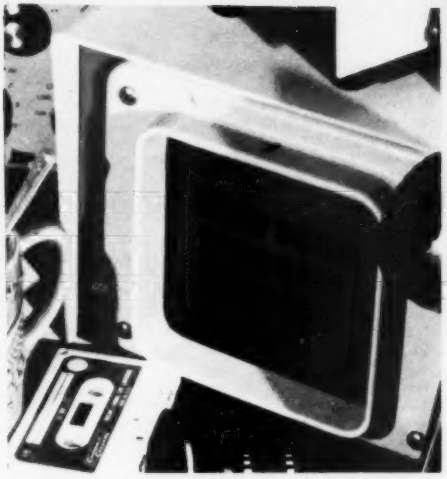
The story does not end there. Not content with his original escapade, he re–appeared on 11 meters again, this time to take credit for his original deed. As if that were not enough, according to Newsweek the language he used at that time was the type that might make the proverbial sailor blush. So far he has gotten away with it. This incident has finally brought the problem of the mess on 11 meters to the eye of the American public. While we in amateur radio have known of the CB problem for years and have tried in vain to get the FCC to do something about it, now the situation has reached just about every livingroom in the country. Incidents such as these point out dramatically why the Citizens Radio Service should not ever be permitted to expand, especially into the amateur bands. If they cannot police themselves, and the FCC is not willing to do so on a large national scale, then the service is totally useless and should be phased out as soon as possible. I strongly recommend that every amateur acquire a copy of the afore mentioned Newsweek article and read it. It's an excellent journalistic effort and worthy of commendation. As for "Larry", well we can only hope that he will be caught and punished.

I have spent a lot of time in New Mexico in the past few years and have a number of friends living there. My wife Sharon and I spent part of our honeymoon there and we again visited the Albuquerque area while en–route to California last year. Though there are a number of repeaters in the area, the only one I had rocks for was WA5JDZ located west of the city atop Mt. Taylor. This is an open .34/.94 machine with possibly the most distinctive identifier I have ever heard. It is also one of the friendliest repeaters I have ever come across and the amateurs that operate it went out of their way to make our five days in the "Duke City" an event we will find it hard to forget. The repeater covers the area along i–40 quite well from about 70 miles east of Albuquerque and we were still hearing it on our IC–2F when we approached the Arizona border. With a 10,000 foot mountain under your machine you can cover a lot of miles. Since I am planning to expand LW to encompass the entire Southwestern United States, I would enjoy hearing from the Albuquerque group and any other repeater people in the area.

Back home in LA, I had the honor to be invited for a tour of the brand new L.A. County Sherrif's Communications Center, a good part of which is devoted to amateur radio. While many cities have abandoned or shelved amateur radio as a communications system, Los Angeles has taken just the opposite view. They realize the value of a well organized RACES communications network and its value in time of emergency and have backed up their opinion with facilities and equipment to implement the system. My guides, Lou Scherer WB6OON and Sgt. Frank Oakden spent quite a bit of time explaining the new system and

73 1st Annual magazine's RULES:

- 6 minute maximum time length
- Subject matter is limited only to your imagination – anything goes.
- Label cassette with your return address and include sufficient return postage. All programs will be returned.
- Decisions of the judges will be final.
- Contest starts now – entries must be mailed before December 31, 1973.



First Prize **ROBOT Model 61**
Fast Scan Viewfinder
Other prizes to be announced.

Send your entry to: Slow Scan Contest, 73 Magazine, Peterborough, NH 03458.

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asked if I would mention that they are looking for recruits, some 5,000 of them! If you are an amateur of Technician class or higher, and live in any area served by the LA County Sheriff's Department, this might interest you. Contact the LA County Sheriff's Department for more information.

L.W. wishes to congratulate Walter Braunstein W6EJK on his election to the Presidency of the Pallisades A.R.C. of Culver City. They are without a doubt the most active amateur club in Southern California, and have found many ways of involving amateur radio in their daily lives. Their repeater WR6ABB was set up as thier club station, available to all members at all times. I received the honor of being asked by Walt to become co–chairman of the club TVI committee, along with Martin Geisler WA6TIC who has done quite a job in that position for a long time. If I come up with any interesting cases or cures, I'll be glad to pass them along.

Since the holiday season will soon be upon us, Sharon and I wish to take this opportunity to wish you all the best of holiday wishes and we will be seeing you in the New Year.

WA2HVK/6

FORT WAYNE HAMFEST

A Hamfest will be held in Ft. Wayne IN on 13 January, 1974 at Shiloh Hall on Carroll Road, west of IN-3; flea market – food – 807's – softies. $1 in advance – $1.50 at the door. Tables – 4 feet $1.

For info write: A.C. Arts, PO Box 342, Ft. Wayne IN 46801. Talk in 94/28 – 88/52. Electronics equipment only please.

KITTY HAM

December 17th, 1973 marks the 70th anniversary of the first powered flight which the Wright brothers made at Kitty Hawk, North Carolina.

The Raleigh Amateur Radio Society and amateurs from the Kitty Hawk area will operate special event station KH4NC at Kill Devil Hill which was the site of the historic flight.

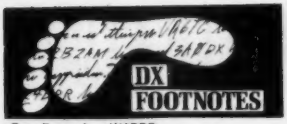
Operation of the special event station is in commemoration of that first powered flight by the Wright brothers which marked the birth of modern day aviation.

Proposed operations will be conducted from 0000 GMT, 15 December through 2400 GMT, 17 December 1973. Frequencies to be used will be 3530, 7030, 14030, 21030 and 28030 kHz - CW, and 3910, 7210, 14280, 21355, and 28505 kHz phone. Note that these frequencies are approximate and amateurs should listen on these frequencies plus or minus 10 kHz. Some operating time will be devoted to the novice class sections of the above bands. In addition to these operations, an Oscar satellite ground station will be set up for possible contacts through Oscar 6.

A special commemorative QSL card will be available to stations contacting KH4NC, SASE please, via K4CIA, PO Box 17124, Raleigh NC 27609.

MN HAMFEST

The winter PICONET-HANDI-HAM hamfest will be held Saturday December First 1973 at the Eagles Club in Fairbault MN. There will be a dinner, program and prize drawing. Registration starts at 9AM. Contact Don Franz WØFIT, Secretary-Treasurer PICONET, 1114 Frank Ave., Albert Lea MN 56007.



Gus Browning W4BPD
Drawer "DX"
Cordova, SC 29039

DX is back with us again, here it is wintertime and the bands are full of some mighty good DX again. Better get in there and join in on the fun. According to one of the propagation predictions editors of one of the magazines the sun spot cycle may pass through its minimum some time this winter. I am sure we all hope he is correct in his "prediction" It's pretty tough sledding when those sun spots are at a very low count.

W3AG has moved over to Greece and it looks like he will be there from "now on" and (get this) he lives only about 25 or so miles from the border of Mt. Athos ! It seems it's easier to get a Mt. Athos license than a SV license, because he is now on the air in Mt. Athos with the call SY5MA and is working the boys, especially a lot on CW. In case some of his old buddies want to drop him a line over there, here is his address (in Greece);

Willard Hunton,
c/o Mrs. Loch, The Tower,
Ouranoupolis, Greece

Willard tells me in a letter that he will hang out around the portions of the bands where Generals or anyone else can work him. His QSL manager is W4KA, and Willard will send his logs back every two weeks so the QSL cards will go out pronto.

Anticipated hours of operation will be: 0600-0800; 1000-1200; & 1400-1600 GMT. Will also use the low end around 14010, 21010 etc. (ed.-I predict Mt. Athos will shortly be removed from the rare country list).

There seems to me quite a bit of activity around the Indian Ocean with the fellows from the Seychelles going to some of the outlaying islands on DXpeditions. I suggest that those of you who need this area keep in touch with the gang in Mahe, Seychelles. They can tell you of their future plans. We all hope they continue to do this. My only regret is that I am not with them, sure would be nice to see those beautiful islands again.

Have just about got a new country list made up for our WTW. By counting the places various National Associations counts the new total will be something around 375 to 400 or so. You had better start looking real close at all those Russian cards, a number of them will be added to our list, also quite a new more under FO8, and still a few more, here and there. A SUPER WTW ? ! Am considering a new award that will be called the "SUPER WTW" ! Am not sure yet that the "Boss Man" (Wayne Green) will go along on this or not. The idea of this award is to have "lots" of DX areas on the list, almost any island (even Catalina, Long Island, etc. and count even every state in the USA, every province in Canada, every-Helvetta in Switzerland, every district (licensing district) in South Africa, every district in Australia, etc. etc. You could really say that you have Worked The World if you were the Top Man on the Super WTW Honor Roll! We would start an Honor Roll each month for "our" Super WTW. I would think such an award would be an award to stop all other awards! How does that strike you fellows who want "real activity" on our bands? Am sure I will hear from the gang on on this! I can just hear 'em now,saying that crazy fool, Gus is about ready for the Bug House and a strait jacket!

Our WWDXA (World Wide DX Association) is coming along very FB. At the time of writing this the membership is getting up near 50 I would guess, and growing each day. Every $ 6.00 yearly membership fee has been put in the bank and as long as I can stand it, will continue to be put there to be used only for the betterment of DX when the occasion arises. Before we start tapping this account we want a very sizeable amount in the bank first. You can be sure the "occasion" will have to be a good one.

I have often wondered why a small low powered rig with a very makeshift antenna with a high SWR will Work The World with very nice signal reports from a DX spot and the very same rig back "home" will not even get a CQ answered ? I guess it's that 20db "added" signal report you have when you are DX, the rarer the spot the more db's your signal will have, or it certainly seems like to me, but, every time I think of low power I think of Howie, W2QHH and all the awards and certificates that he has earned. Howie is not in a rare state. (N.Y. State is not rare to anyone). W2 is not a rare call area, Howie was letter carrier (mail man) when he got most of those FB awards which means that he could not "sneak" home to get a new one when it showed, all this and usually only a dipole or long wire (actually you and I would call it a short, long wire), and he lived in a (and still lives there as far as I know) small New York village in a sort of valley. His power has never exceeded 75 watts, usually was around 35 watts, I even worked him from AC3PT ! (he was RST 339 on 21 mc CW). To me this only goes to prove that you can "do it" on low power, but a lot of good friends and some letters undoubtly helps a bit too, and a lot of good down to earth planning and being "very persistant" for that new one. I guess in the end its the operator more than anything else that gets the results. Anyway, my hat is off to him. Howie may have done it the hard way, BUT, he got the job done, and how !

We are still in need of some radio clubs in various parts of the country to act as verification points for the WTW award. If your club is interested in this small task drop me a line and lets get together. Your club will get a little publicity when we list our verification points occasionally in this magazine, very little actual work involved. How about your club joining up with us on this little project ?

Have attended quite a few conventions around the country this year and all the fellows want more and better DX on the air, they would like to have more "professional" DX operators on the other end of the pile-ups and if possible more activity when the DX station actually gets on the air from the rare spots and when it's all over a "speedy" QSL would make the hunt a very FB success to the whole thing. Without that all important QSL card for verification purposes the whole chase becomes more or less useless.

If any of you happen to know of a DX station that is looking for a Stateside QSL manager let me know because I usually have a number of stateside hams who would like to be a QSL manager for DX stations (ed.-they can have that job and all the hard work that is involved).

It is with deep regret to announce the death of W3GHD, Bob Wilson on September 9th after being in the hospital only 3 days. Death was the result of a stroke Bob suffered.

The DX world has lost one of it's great operators and a very active ham. Bob was a personal friend of your editor and will be missed by all.

Understand that Wayne went to the hospital for examination, sure hope it's nothing serious and is back on the job again by now.

SAY GANG, some of the applicants for both WTW and 73-73-73 award is not sending the $ 1.00 fee. This slows things down, so, how about remember this fellows and save me time and work ? Many Thanks.

73 es DX, CU next month, de Gus BPD

73 REPEATER ATLAS REGISTRATION

REPEATER CALL (WR only)	FORMER CALL	LOCATION (City)	STATE

INPUTS	OUTPUTS	TT Wh TB PL	FM AM RTTY	AUTO PATCH	ERP	
		Hz				USEFUL RANGE (RADIUS)
		Hz				EQUIPMENT
		Hz				
		Hz				
		Hz				☐ SPLIT SITE ANTENNAS & HEIGHT ☐ DIPLEXER

REPEATER GROUP/SPONSOR	TRUSTEE	ID—TYPE OR MFR.

☐ I certify that I have received no outside assistance while completing this form.

DATE	SOURCE (NAME/CALL)	SPECIAL OR EMERGENCY FUNCTIONS

AZ	WR7ABQ	Phoenix		146.34-146.94 146.16-146.76
AZ	WR7ABR	Phoenix		146.04-146.64
AZ	WR7ABS	Phoenix		449.3-445.3
AZ	WR7ABT	Phoenix		146.22-146.82
CA	WR6ACF	San Diego		146.64-146.64
CA	WR6ACA	L.A.	RTTY	146.19-146.79
CA	WR6ABT	West L.A.		Closed
CA	WR6ACD	L.A.		146.22-146.82
CA	WR6ACJ	L.A.		146.25-146.85
CA	WR6ABO	L.A.		146.34-146.94
CA	WR6ABW	L.A.		Closed
CA	WR6ABI	L.A.		Closed
CA	WR6ABA	L.A.		147.81-147.21
CT	WR1ACD	Monroe		146.235-146.835
FL	WR4ACZ	Pensacola		146.16-146.76
GA	WR4ABN	Atlanta		147.63-147.03
GA	WR4ACX	Eatonton		146.10-146.70
IA	WR8ACF	Ayrshire		146.22-146.82
ID	WR7ABX	Moscow Mtn.		146.22-146.82
IL	WR9ABY	Chicago		146.16-146.76 449.75-443.75
IN	WR8ACG	Plymouth		146.07-146.67
KS	WR8ABZ	Winfield		146.16-146.76
MA	WR1ABX	Holyoke		146.34-146.94
MA	WR1ABY	Maynard		147.84-147.24
MA	WR1ACB	Bellingham		146.46-147.06
NC	WR4AON	Elizabeth City		146.28-146.88
NY	WR2ACB	Long Island		146.16-146.76
NY	WR2ACI	Valhalla		147.66-147.06
NY	WR2ACK	Gloversville		146.16-146.76
TN	WR4ADF	Knoxville		52.76-52.525 146.34-146.94 449.3-444.3
TN	WR4ADO	Kingsport		146.16-146.76
TX	WR5ACF	Lufkin		146.34-146.94
VT	WR1ACA	Mt. Ascutney		146.16-146.76
WA	WR7ABZ	Yakima		146.34-146.94
WI	WR9ABF	Milwaukee	PL	52.85-52.525
			PL	147.99-147.39 449.5-444.5 1259.0-1220.0

INTRUDER CHASE

Jonathan Tara WB8DBN
16260 Greenfield
Detroit MI 48235

Contrary to popular opinion, there are several things you personally can do to rid our bands of intruders. If you wait for someone else to do it, their numbers will just continue to mount.

First off, you can write a letter to the offending station. Don't laugh, it works — sometimes. You may think that the station obviously knows that it is operating illegally and that your letter will wind up in the proverbial circular file. On the contrary, the station is not technically in violation of international regulations until it has been told that it is causing interference. It may be obvious to you that a megawatt on 7250 beamed to North America is going to cause trouble, but the broadcast station will take full advantage of this technicality. The truth is that these stations seldom get complaints. You may be surprised and get immediate satisfaction — the BBC agreed to reduce the level of their 20 meter second harmonic by 6dB in response to a letter from me. In other cases it may be slower — Radio Moscow invited me to send them tapes showing interference caused by their transmissions. ("We shall be glad to receive a cassette tape recording. . .please make it 7 1/2 i.p.s.")

Keep the technicalities of the international regulations in mind when you write the letter. You won't get anywhere by accusing the station of operating illegally. The thrust of your letter should be to inform them that they are causing interference to hams with their transmissions. It doesn't hurt to mention that they *will* be in violation of international regulations if they continue. This way they know that you are familiar with the regulations, so they have to be more careful in answering you.

Be sure to give full details of the transmission, and include a tape if possible. Check the address of the

FCC MONITORING STATIONS

Address your report or complaint to "Engineer in Charge, Federal Communications Commission, (name of city) Monitoring Station," at the various addresses given below, listed alphabetically by city or town. The telephone number for each monitoring station is also listed.

P.O. Box 89
Allegan MI 40901
(616-673-2063)

P.O. Box 1126
Denison TX 75020
(Ambrose Monitoring Station)
(214-965-7729)

P.O. Box 6303 Annex
Anchorage AK 99502
(344-1011)

P.O. Box 470
Belfast ME 04915
(207-338-4088)

P.O. Box 374
Canandaigua NY 14424
(315-394-4240)

P.O. Box 251
Chillicothe OH 45601
(614-775-6523)

P.O. Box 6
Douglas AZ 85607
(602-364-2133)

9900 West State Road 84
P.O. Box 22836
Fort Lauderdale FL 33315
(305-583-2511)

P.O. Box 1588
Grand Island NE 68801
(308-382-4296)

P.O. Box 632
Kingsville TX 78363
(512-592-2531)

P.O. Box 40
Laurel MD 20810
(301-725-3474)

P.O. Box 311
Livermore CA 94550
(415-447-3614)

3222 McLeod Road
P.O. Box 339
Bellingham WA 98225
(Marietta Monitoring Station)
(206-734-4196)

3600 Hiram-Lithia Spring Road, S.W.
P.O. Box 85
Powder Springs GA 30073
(404-943-5420)

P.O. Box 181
Sabana Seca Puerto Rico 00749
(809-784-3772)

P.O. Box 5126
Santa Ana CA 92704
(714-545-1333)

P.O. Box 191
Spokane WA 99210
(509-244-2141)

P.O. Box 1035
Waipahu HI 96797
(808-677-3954)

station in the World Radio TV Handbook, which will also give you the name of the Chief Engineer. If you can't get your hands on one, drop me a line.

If a local broadcast station is the offender (harmonics) you might try a phone call to the Chief Engineer. He'll probably be happy to have the problem brought to his attention before the FCC finds out.

Next, you might try the FCC. I have found them to be of little use, but you may find them helpful. One thing they are good for (if you can afford to call the nearest monitoring station) is to get bearings on an unknown station. Unfortunately, all monitoring stations are not operated 24 hours, and it may be difficult to get a bearing. For example, I called the Allegan, Michigan station to check on a commercial RTTY station on 40 meters. Since they only had a station in Florida to work with, the best they could tell me was "the West Coast of South America."

The FCC will take your name and call, and supposedly you will get some word from them as to what happened to your report. However, I have never received any such confirmation. I get the impression from talking to them that they are busy with other things, and really don't want to spend the time.

And finally, you can complain to Intruder Chase. This will be described in full next month, but basically it will serve to validate reports to make sure that the offending stations get accurate information and to coordinate reports. This way a station can't send out letters to a hundred people telling each of them that theirs was the only complaint received. The Intruder Net will keep interested people more closely informed on the current situation, as well as being invaluable for direction finding. I should have a couple of direction finding antennas for 40 ready soon, either to be described in a future column or for an sase.

By the way, the Chase is not trying to compete with the ARRL Intruder Watch, but is in *addition to it*. All reports to the Chase will also be forwarded to the ARRL. We will try every avenue available to get rid of the intruders.

There is no intruder listing for this month, since I haven't gotten any reports yet due to the publishing delay.

... WB8DBN

AMSAT NEWS

Michael Frye WB8LBP
640 Deauville Dr.
Dayton OH 45429

AMSAT's activity during the next year is expected to continue to focus on the OSCAR 6 and A–O–B satellite projects. Concurrently with this activity, AMSAT is exploring with WIA–Project Australis and AMSAT Deutschland; the development of new satellites to be constructed by these groups using some AMSAT–provided A–O–B series hardware, along with new communications repeater experiments. Additional projects showing excellent progress toward use for future OSCAR satellites include a new spaceframe structure under development by Project OSCAR, Inc. in California and 144–to–435 MHz linear repeaters under development in Germany and Australia.

In addition to technical activities, efforts are now underway to secure funds for continued AMSAT projects, directed not only toward providing more advanced satellites of the A–O–B series, but also toward developing the capability of building AMSAT payloads for synchronous, near–synchronous and synchronous–transfer orbits. The funding for these projects, estimated to require nearly $100,000 per year, will necessitate additional donations from individuals, as well as contributions from other sources. Assisting with the fund–raising efforts will be the new ARRL Foundation recently established by the League Board of Directors. One of the first functions of this foundation will be to obtain donations for satellite projects. The directions future projects take and the overall level of AMSAT activity in the years to come will be dependent upon the degree of financial support obtained by the new foundation.

WB1DNW has reported seeing OSCAR 6 thru his telescope at the Talcott Mountain Science Center. After many nights of careful planning along with the waiting for a clear sky Bob was rewarded with the satellite showing up as a small white dot in the sky. It's no small task to find a tiny object less than a yard across at a distance of 115 miles. But as Bob has proved it is far from impossible.

The ARRL is sponsoring a 10 meter contest on December 15 and 16 to

promote activity on this band. The news however is that they are allowing satellite contacts to count as points in the contest. Complete details are available from the League.

OSCAR 6 celebrated it's first birthday October 15. For the occassion AMSAT drafted a taped message which was broadcast over the satellite during the referance orbits for a week. The fact that Oscar 6 survived for this length of time is a boost to AMSAT and all the people who have helped around the world. It is also an indicator that future satellite's of an improved design can last for much longer periods of time.

December Orbital Information

REV	DATE	TIME Z	LONG W
5151	1	0046.6	59.3
5164	2	0141.6	73.0
5176	3	0041.5	58.0
5189	4	0136.4	71.8
5201	5	0036.4	56.7
5214	6	0131.3	70.5
5226	7	0031.2	55.5
5239	8	0126.2	69.2
5251	9	0026.1	54.2
5264	10	0121.0	67.9
5276	11	0020.9	52.9
5289	12	0115.9	66.6
5301	13	0015.8	51.6
5314	14	0110.7	65.3
5326	15	0010.7	50.3
5339	16	0105.6	64.1
5351	17	0005.5	49.0
5364	18	0100.5	62.8
5376	19	0000.4	47.8
5389	20	0055.3	61.5
5402	21	0150.3	75.2
5414	22	0050.2	60.2
5427	23	0145.1	73.9
5439	24	0045.1	58.9
5452	25	0140.0	72.7
5464	26	0039.9	57.7
5477	27	0134.9	71.4
5489	28	0034.8	56.4
5502	29	0129.7	70.1
5514	30	0029.7	55.1
5527	31	0124.6	68.8

Summary of AMSAT–OSCAR–B Spacecraft System

AMSAT Deutschland Repeater (designed by Karl Meinzer, DJ4ZC). Input frequency passband between 432.125 and 432.175 MHz. Out frequency passband between 145.975 and 145.925 MHz. Power output (high power mode) is 14W PEP. Downlink passband is inverted from uplink passband. Repeater is 45% efficient using envelope elimination and restoration technique. Linear Operation– SSB and CW are preferred modes. Repeater is commandable to either 3.75 or 14W PEP output. Telemetry beacon at 145.980 MHz (200 mW).

AMSAT Two–to–Ten Meter Repeater (designed by Perry Klein, K3JTE) Input freq. passband between 145.85 and 145.9 MHz. Output freq. passband between 29.40 and 29.50 MHz. Power output is 2W PEP. Downlink passband is not inverted from uplink passband. Linear Operation – SSB and CW are preferred modes. Telemetry beacon at 29.50 MHz (not same as OSCAR 6).

Morse Code Telemetry Encoder (designed by John Goode, W5CAY). 24 analog input channels. Converts each analog value into a two–digit Morse code number or "word." A third digit precedes the telemetry value and gives the line number in which the word is located. Format is arranged 4 words per line, six lines per telemetry frame. Morse code rate is commandable to 10 wpm or 20 wpm.

Teletype Telemetry Encoder (developed by Peter Hammer, VK3ZPI and Edwin Schoell, VK3BDS). 60 analog input channels. Converts each analog channel to a three–digit number transmitted in Baudot code. Each three–digit value is preceded by its channel number, making a five–digit telemetry word. The data is arranged 10 words per line by six lines per telemetry frame. Two lones of status information follow the analog matrix and give the spacecraft time (i.e., time in "counts" from launch, 1 count = 96 minutes). Output keys 435.1 MHz beacon in FSK: 850 Hz shift; 45.5 Baud: (reversed from U.S. standard). Also keys 145.98 and 29.50 MHz beacons as AFSK, on command.

435.1 MHz Beacon Transmitter (developed by Larry Kayser, VE3QB and Bob Pepper, VE2AO). Beacon output freq. is 435.10 MHz. Power output is 0.4W at an efficiency of 45%. Beacon is FSK modulated 850–Hz shift.

2304 MHz Small Beacon Transmitter (developed by San Bernadino Microwave Society). 0.1W at 2304 MHz. Turned on by command only for 30 min. periods. CW keyed – HI followed by 30 sec. carrier. Also keyed with Morse Code telemetry on command.

Codestore – Message store-and-forward system (built by John Goode, W5CAY). 896 bit memory capacity using COS/MOS shift register memory. Loaded via command link. Output code speed is 13 wpm.

Experiment Control Logic (designed by Jan King, W3GEY). Selects the spacecraft operating modes. Protects satellite against excessive battery drain by reducing repeater output power or by shutting it off completely.

Input Solar Power / Battery Charge Regulator (developed by Karl Meinzer, DJ4ZC and Werner Haas, DJ5KQ). Converts 6.4V at arrays to 14V to charge battery or to supply the spacecraft experiments. Senses overcharge of battery and reduces charging current. Senses failure of either of the two redundant regulators and switches to the opposite regulator automatically.

AMSAT–OSCAR–B Spacecraft

A–O–B (to be known as OSCAR 7 after launch) is an international effort now involving four nations. The A–O–B systems developed in each country are as follows:

Germany: AMSAT Deutschland Repeater, Spacecraft Structure, Battery Charge Regulator, 28V Power Regulator, Antenna System – DJ4ZC, DJ5KQ.

Australia: Two Redundant Command Decoders, Teletype Telemetry Encoder – VK3ZPI.

Canada: 435.1 MHz Beacon Transmitter – VE3QB and VE2AO.

United States: 2M/10M Repeater, Morse Code Telemetry Encoder, Experiment Control Logic, Instrumentation Switching Regulator, Solar Panels, Battery – K3JTE, W3GEY, WA4DGU, W3DTN, Marie Marr. Codestore – W5CAY. S-Band Beacon Transmitter – K6HIJ.

... WB8LBP

HAM HELP

This column is for those needing help in obtaining their amateur radio license.

If you are interested, send *73* your name, address and phone number. Don't be bashful – remember, it's always easier when you have someone to give you that added bit of confidence.

73 would appreciate amateurs and clubs looking this list over and helping whoever they can. Do you remember when you needed help?

Robert White
365 Clinton River Dr.
Mt. Clemens MI 48043
468-4746

Allan Kowal
21-2800 Allwood St.
Abbotsford B.C. Canada
859-7928

John Diecker
9968 Northamton Dr.
St. Louis MO 63137
314-868-2905

James Taylor
1516 Sheley Rd.
Independence MO 64052
816-252-4844

Joe Kasser
1701 East-West Highway, Apt. 205
Silver Spring MD 20910

A recent column briefly mentioned the value of mint or unused U.S. postage stamps as gifts for foreign hams when travelling overseas. They are useful to those avid dx-ers who wish to send QSL cards direct to stateside QSL managers so as to receive the QSL's by return mail (hopefully).

Well the same thing works in reverse. If, for example a stateside station works a station in Andorra with a QSL manager in Germany, a direct mail QSL would require three IRC's, costing about 60¢ to be used to purchase postage stamps costing about 20¢ to pay for the return postage. Wouldn't it be better to get German stamps at (anything up to twice) what they cost at the German Post Office, and use those to prepay that QSL? If the stateside station sends many cards overseas he may even be able to save enough money to buy a new linear if he gets stamps instead of IRC's. Of course with the linear he will work more stations and so send out more cards and save even more money. Or will he? Think about it.

Where do you the stateside ham get foreign stamps? You probably don't have to look further than your local radio club. Surely at least one of the members is a stamp collector. He will know where to obtain them. In case you can't locate a philatelist let me suggest one or two ways.

The cheapest way of obtaining unused (mint) foreign stamps is to get them at the local Post Office (overseas). Living in a different country that is obviously impossible, but the words "mail order" should be very familiar to the Americansear. Practically every post office in the world runs a philatelic bureau to sell unused postage stamps to collectors all over the world. They will usually be only too pleased to put you on their mailing lists and send you periodic announcements of their new issues. With a small handling charge you can order any current stamp at face value. How do you find out what values of stamps you need? Simple, just ask in the QSO. Ask "what does it cost in your money to send an airmail letter to my country?" In case you forgot the foreign currency equivalent of 25¢ will usually be more than enough. Just drop a line to the Post Office Philatelic Bureau of his country (that should be enough address in most cases – after all the Post Office delivers the letters and they should know the address of one of their own departments) asking for details of their bureau and of their current issues. When you get the details, order any stamp or stamps that will make up the value you need. It will be better if you can arrange to order in bulk getting stamps for the other chaps at the radio club at the same time. This splits the small handling charge into a negligible sum. You can even con them into getting the stamps to put into their own albums, or to give to their nephews as a present or two, if they don't need them (or think they don't need them).

If you don't want to try the bureau route, and what direct QSLer does? to obtain postage stamps the alternative is to obtain them from a stamp dealer. Many stamp dealers put out weekly or monthly "new issue sheets" listing new world issues that they have for sale. Advertisements for these lists can be found in stamp collecting magazines available at your local magazine or book store or even in your local library. These dealers charge anything from 10% to 100% above face value for their services. This is more expensive than the bureau route, but what isn't. Just read the classified ads in the magazines, choose a dealer or two and ask to be put on the mailing list. If you order small amounts from time to time you should be able to stay on the list.

Another method of obtaining stamps is to have friends and/or relatives in overseas places and to get the stamps from them. If you can come to an arrangement with a member of the flight crew of an international airline, so much the better because you can save on the outward postage as well if he or she will mail your letter in the foreign country.

If anyone reading this is a philatelist, I have a small collection too. Perhaps you may be interested in trading one or two. If you have any information that a travelling ham might find useful let me know please, and I'll pass it on in this column.

G3ZCZ/W3

The Hamburglar

STRIKES AGAIN!

Stolen 10/8-Sonar FR-2528 scanner No. 21-4250. Standard src-851-SH 2 meter xcvr No. 9725. Standard src-707C 450MHz xcvr No. 2833. TPL PA-6-1DE 450Mhz amplifier No. 1092. RP MEA-22 synthesizer No. 212, and two LARSEN mobile antennas. Contact Mr. Ed Doherty, 25 Crescent Dr., Beacon NY 12508.

Standard Model SRC-146A FM transceiver in leather case, serial 208070, was stolen from aircraft at Los Angeles International Airport on October 5, 1973. Xtals installed – four amateur and one national weather service. Contact: Lt. W.L. Robinson, SLPD, Chief Security, Salt Lake City International. Phone (801)328-7652 or PO AMF Box 22084, Salt Lake City UT 84122.

A Swan 270 M-252616 along with its automobile was stolen in front of the Holliday Inn in Sumpter SC on September 15, 1973. As of now it has

QTH CHANGE?

To be absolutely sure that 73 will follow you to your new QTH, try to notify our Subscription Department at least 8 weeks in advance of your move. Please include your old address and call as it appears on your current mailing label – or better yet, send the label itself.

OLD ADR (or mailing label)

NAME _____ CALL _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

NEW ADR

NAME _____ CALL _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

not been recovered. Contact Harold L. Manning W4NTB, 2107 Princess Place Drive, Wilmington NC 28401.

LIST FROM PAST ISSUES

AF68 No. 10888	K5LKL	1/73
PMR8 No. 10918		
M1070 pwr supply		
Trio TR2200 No. 241968	WA2ZBV	1/73
Clegg 22er No. 1900-578	WIDHP	2/73
Standard 826M,No. 112007	WA8PCG	3/73
FM27B No. 27013-1141	W2LNI	4/73
FM-144-10L No. F469	WA8WOA	4/73
NPC 107m pwr supply 2, 5AJ-IPL Onan Gen., No. 327885		
R4B No. 11578G	WA8GVK	6/73
T4XB No. 17801 G		
W4 wattmeter No. 8390		
Swan 250 No. F154806		
Swan ac pwr. sup. No. 0653556		
HR-2 No. 04-C2679	W6GSR	6/73
SB-34 No. 211826		
STD 826 No. 011268	WA2FSD	6/73
HT220 No. GJ7327	State Univ. of NY (Albany)	6/73
Yaesu FT-101	W4GF	7/73
No. 82G122788CW		
HR-2 No. 0302030		
Clegg 27B No. 72013-1068	W3BXL	7/73
Std. 826MA No. 208078	WB2DEW	7/73
Drake ML-2 No. 10582	W3MSN	8/73
Tektronics 453 Scope	WB2FZU	8/73

QSL CONTEST

Larry Greenberg of Roslyn Ests. NY wins the QSL contest this month! Show your card to the world and win a free subscription to 73. Send your entry to QSL Contest, 73 Magazine, Peterborough NH 03458.

NEW PRODUCTS

SOLDER GUN TIPS

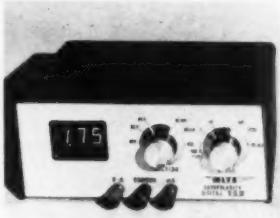
Many technicians, experimenters and electronic assembly workers have given up the use of soldering guns when working on solid state circuits because of the danger of causing damage to delicate components. Most now use low-wattage soldering irons and solder suckers. The development of a new solder gun element by Gunmaster Universal Industries which accommodates interchangeable soldering tips and solder removers has re-

stored the solder gun as a practical tool for working on printed circuit boards.

The element, which will fit most of the popular solder guns, is permanently installed. For soldering, plastic sealing, marking, burning, etc., a tip, known as the SLUG, is screwed into the front end of the element. For removing solder by capillary action, the hollow bore desoldering tip, known as the DUM-DUM, is screwed in place. And for removing heavy solder deposits, a solder sucker may be attached to the back end of the DUM-DUM.

For more information on the versatile attachments, contact *Gunmaster Universal Industries, PO Box 743, Kings Park NY 11754.*

DIGITAL VOLTMETER



Now a low priced laboratory quality digital voltmeter is available from MITS, Inc. Model DVM 1600 measures alternating and direct current in five ranges from .1 ma to 1 amp. AC and DC voltage is measured in four ranges from one volt to 1000 volts. Measurement of ohms is in six ranges from 100 ohms to 10 megohms.

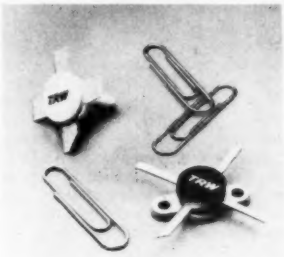
The resolution in low ranges for voltage is 10 mv; for current, 10 ma; and for resistance, 1 ohm. DC voltage accuracy is ± .5%. All other measurements are accurate to ± 1%. Input impedance for DC voltage measurement is 10 megohms; for AC voltage, 1 megohm.

The DVM 1600 also features auto polarity which automatically displays polarity and magnitude without probe reversal. Other features include a regulated power supply and 100% overrange capability on all ranges. Power requirements are 115/230 VAC, 50/60 Hz, 20 watts. The two plus digits are of bright, easy to read Sperry gas discharge. The attractive brushed aluminum case has an overhang for better visibility.

The MITS DVM 1600 is available in an easy to assembly kit or factory assembled. Warranty on the assembled model is one year on parts and labor. Kit warranty is ninety days on parts. The price is $89.95 for the kit and $129.95 assembled.

Contact *MITS Inc., 6328 Linn Avenue, NE, Albuquerque NM 87108, (505)265-7553.*

100 WATT PEP TRANSISTOR



A new 100 watt PEP and CW RF power transistor is now available from TRW Semiconductors, an Electronic Components Division of TRW Inc., Lawndale, California. The devices, designated PT5788 for the stud mounted version, and PT6665A for flange mounted, operate at 100 watts both peak envelope power and CW, which is believed to be a first in the high power range.

The devices are intended primarily for single sideband HF radio applications and should find many used in amateur radio.

The PT5788 and PT6665A feature intermodulation distortion of only 32dB and a minimum power gain of 14dB.

The rugged units incorporate thermally isolated cells and individually ballasted emitter sites for improved reliability and stable operation.

Up to 200 watts of power are available in an amplifier by combining two of the devices. Up to 320 watts and a power gain of 17dB can be achieved with 4 devices. TRW considers the 4-device unit a basic building block. Summing circuitry and mechanical links are widely available to make it easy to combine four of

LETTERS

A REPEATER STORY

Licensing our simple, manual, locally controled repeater turned into one of the most mixed-up and confused messes that could be imagined.

Drafted into applying for the repeater license was George Silvius W3LA, a retired army sgt. . .Dave Butler WA3SKJ, a communications engineer. . . and Al Brown WA3FYZ, a broadcast engineer. These diversified talents combined with the unclear and often contradictory instruction of the FCC, led to almost complete confusion these last few months.

Our story starts with the application. Since there are no repeater applications as such yet, modification had to be made to an FCC form 610-B, which is the application for a secondary station.

Next we had to determine the antenna gain, vertical and horizontal radiation patterns. By utilizing that acquired data, the effective radiated power was to be found, since the transmitter output power, and coaxial losses were readily available. (HA)

Finding the transmitter antenna height above average terrain was fun also. No less than forty points had to be plotted on a map and the average of these determined the average height of the terrain above sea level. This figure compared with the antenna height above sea level, gave our antenna height above average terrain (HAAA!) In our particular case it was minus six and one-fourth feet.

So now, all the data had been procured and was ready for filing with the FCC. The form 610-B had been modified, signed, dated, and all sections filled out. George even made a special trip to the library to make a xerox copy of his license to submit. A copy of the club constitution was readied. Five pages of algebra, arithmetic, logarithmic, and decibel conversions and graphs on antenna gain as 3.75 dB and even by our trial and error, hit and miss, flim-flam methods, we barely made 3 dB at times. EH!

By using a figure of around 3 dB, the ERP worked out to about 90w and George hand carried this entire package to the FCC in Gettysburg. They looked through it. . .said it seemed OK and since he was known so well up there that there was really no need for him to attach a copy of his license. So he didn't.

Well, after several weeks of hopeful anticipation, the repeater application was kicked back. It seems that although George was known in Gettysburg, he wasn't very popular in Washington. Back to the library. Application was refiled plus a photocopy of George's license minus the club constitution which the FCC said was superfluous information.

Well, once again, after several weeks of hopeful anticipation, a phone call from the FCC revealed that tests were run on that type of antenna and the true gain was found to be 2.8 dB. This meant recalculation of ERP. The next morning the FCC called again and the gain was down to 2.5 dB and the antenna was accepted on the FCC approved list. This meant recalculation again of the ERP and the deletion of five pages of information on antenna gain figures and patterns. By late afternoon the FCC dropped that figure to 2.0 dB. Seems strange that we had the only application with that type of antenna that did not say 3.75 dB. Oh well, we caluclated for 2.0 dB and resubmitted. The application was kicked back because there was no copy included of the W3CWC license. . .back to the library.

Three weeks after that we received the license and call sign WR3ABT, club repeater station. Licensed to Antietam Radio Association, George E. Silvius, Trustee.

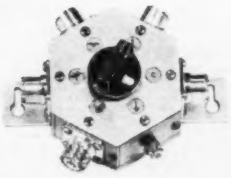
Al Brown WA3FYZ
Dave Butler WA3SKJ
George Silvius W3LA

these building blocks to provide a 1kW amplifier.

Price for the PT5788 and PT6665A in 100 level quantities is $38.50. The units are available from authorized TRW distributors.

For further information contact *Sales Manager, TRW Semiconductors, an Electronic Components Division of TRW Inc., 14520 Avaiation Blvd., Lawndale CA 90260; phone (213)679-4561.*

ANTENNA SWITCH



The Heath HD-1234 is designed to switch one RF source to any one of several antennas or RF loads while grounding the unused outputs. Two Heathkit Coaxial Switches can be used to switch up to four antennas/loads to four different units (transceivers, transmitters, receivers, etc.).

Standing wave ratio to 250 MHz is l.1:1 maximum. Power capability is 1000 W (2000 W PEP). A bracket is provided for mounting on equipment cabinets, desk or wall.

Price of the HD-1234 Coaxial Switch is $9.95 mail order. For more information, contact *Heath Company, Benton Harbor MI 49022; phone (616)983-3961.*

WHERE OH WHERE QSL?

The Radio Society of Okinawa has a substantial amount of QSL cards of both KA6 & KR6 calls. The hams who operated these stations have since left the island. Any former KR6 or KA6 holder who wants his cards contact the Radio Society of Okinawa, Box 465, Fort Buckner, APO San Francisco CA 96331. There are many call signs too numerous to list.

QSL Information: All KA6 QSL Cards should be sent to the Radio Society of Okinawa and not FEARL. The RSO operates and maintains its own QSL Bureau *

Due to the fact that the majority of our members and former members are in the Armed Forces it is impossible for us to reach them due to rotation and address changes. Your magazine could help enormously by publishing this notice.

Anne M. Szczesniak
QSL & Awards Manager
Radio Society of Okinawas,
Box 465 Fort Buckner
APO San Francisco CA 96331

VHF ENGINEERING

I'm not one for writing letters, except usually to complain about something great and evil to me, but the quality, courtsy, and service of one of your advertisers has overwhelmed me. I purchased a two meter FM transmitter kit fro, VHF Engineering shortly after they began advertising. After I disregarded their excellent directions and incorrectly constructed the unit, I mailed it to them. Five, yes only five days latter I received my unit back, repaired, no charge! (Try that with Heath.) The unit gets fantastic reports on the air. Then I purchased the 15 watt amp, and it was on the air in less than an hour after the postman arrived with equally excellent results. From time to time, as

they continue to upgrade their products, they, unsolicited by me, mail information on these upgrading procedures to me. . .at their prices, with their service, and with their high quality, what more could one ask. We need more VHF Engineering Corps in all areas. I wonder if they have considered the manufacture of automobiles. . .

Bob Fox K2MDM
Brooklyn NY

FCC COMMENTS

Just sent in comments on an FCC docket for the first time in my life, and I am going to blame you and the rest of the 73 staff for the cash I was forced to put out (not to mention the lost operating time). Had it not been for your prodding to make the amateur voice known, I would have sat nonchalantly at the operating desk enjoying myself, oblivious to whatever attrocities the FCC may be committing. While I now feel much better about having put in my two-cents worth, it has shown me why more amateurs do not bother to make comments, even on very important matters such as Docket 19759 (CB on 220 Mc.).

It is a difficult task to make yourself sit down and put your thoughts into words in a coherent manner. (Especially for me. . .I am a newspaper reporter and have to do this sort of thing all day, every day, so making myself do it on my own time is no simple matter. But you probably know how that is.) Even so, there is the matter of putting those thoughts into legal terms, and paying to have it reproduced since the FCC requires an original and 14 copies. Of course, if you happen to have a Xerox machine in your hamshack, this cost can be reduced considerably.

Somehow, though, it was an extremely enlightening and rewarding experience. I would not hesitate to do it again.

Charles Wright WA6SLS
Fresno CA

MORE PROSE

I have but one question to ask Mr. A. Prose Walker! Which CB company does he own?

ET'CR Mayward
Kwajalein MI

LORAN

I thought I would take a few minutes to write a quick note to correct a possible mis-conception you, and many of your readers, may have concerning the future of the LORAN "A" systems. You have stated several times that the 160m band would soon be rid of the interference of the LORAN as it is being phased out. May I take this opportunity to tell you of a few recent developments?

This LORAN chain (Central Pacific) was to be closed by the end of this year (as were several others). All LORAN "A" was to be phased out over the next three years. This was, I presume, considered sufficient time for the various organizations to purchase LORAN "C" receivers.

However, such a cry was raised in Washington by the fishermen, the airlines, and the military organizations that his chain has been told it will be operating at least until the end of 1974. Very few of the LORAN "A" stations are to be closed, and more than a few people feel that LORAN "A" will be operational until 1980.

Sorry to have to put a damper on those of us who enjoy operating on 160 meters, but LORAN "A" will be with us for some time.

Rod Mayward
APO San Francisco CA

CARF SI-ARRL NO

As a member of the largest radio club in Canada, the Ottawa Amateur Radio Club, I can report that the majority of members don't think very highly of the ARRL or their Canadian rep Noel Eaton. I think you'll see CARF (Canadian Amateur Radio Federation) gradually becoming the official voice of Canadian amateurs.

Keep up the good work with 73 and our sincere sympathies on your repeater regs.

Bill Stow

1950 PLL

So infallible is the synchronizing performance of Home Television Receivers of today that we are prone to forget the frustrations of picture rolling and tearing of the early sets. But here is a description of an actual occurrence where an ingenious approach alleviated synch problems, resulting in a Human Phase Lock System.

The occassion was the Milan Fair held in Italy in the early 1950's when American Companies were invited to display their receivers. There being no television stations in that Country at that time, participation meant the installation of a complete station with transmitter, cameras, pulse generating equipment as well as the receivers.

As was typical at that time, Vertical Hold of the picture was in step with the power line frequency, a very stable source in the USA. Over there at that time it was not so stable, being allowed to vary as much as several Hertz ' American pulse generators would frequently cop out on these wide excursions and receivers would begin their picture rolling.

Our engineer, now WB4ITQ was interested in preserving the technical excellance of our gear and took a Table Model receiver by car to the nearby power station. Here in glorious sales technique, he gave the operating engineer a vivid description of the wonders of Television, and offering to set one up in the power station for him to watch. Of course an immediate comraderie was established and within minutes a picture was received.

"Ah but that rolling – can it not be stopped? " was the comment of the operator.

"But of course," said our Ham friend. "You just turn this big wheel on your generator like this and Presto!, the picture stops rolling."

As our friend left the power station the operator was smiling, leaning back in his big chair with his feet on the desk, and carefully adjusting the BIG WHEEL so he could enjoy the show.

Progress is important, and so satisfying.

W2IK

ALARMED COMMENT

Re hams selling alarms: I've been selling alarms for about half a year now. I haven't made a killing but have been doing pretty well. I have a demonstration model I use and if anyone has a need for plans for it just send a S.A.S.E. and I'll see what I can do.

Ken Dinsmore
KENCRAFT ARLARMS
10601 Washington Way
Everett WA 98204

FM AGAIN!

You probably don't remember but last spring my friend and I visited your offices and you asked me if I was on 2m FM. The answer was no, but for the past four months about 99% of my activity has been on 2m FM. Thanks for being such an effective catalyst. I've never had so much fun with the hobby!

Jim Kocsis WA9PYH
South Bend IN

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION (Act of August 12, 1970: Section 3685. Title 39, United States Code) 1. Title of Publication 73 Magazine. 2. Date of Filing 20 September, 1973. 3. Frequency of issue. Monthly. 4. Location of known office of Publication (Street, city, county, state ZIP Code) (Not printers) Pine, Peterborough, Hillsboro, NH 03458. 5. Location of the Headquarters or General Business Offices of the Publishers (Not printers) Pine, Peterborough, Hillsboro, NH 03458. 6. Names and address of publisher, editor, and managing editor. Publisher (Name and address) Wayne Green, Peterborough NH 03458. Editor (Name and address) Wayne Green, Peterborough NH 03458. Manager Editor (Name and address) Ronald Subik, 73, Peterborough NH 03458. 7. Owner (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent of more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given.) Name 73 Inc Peterborough NH 03458. Wayne Green, sole stockholder Peterborough NH 03458. 8. Known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages or other securities (If there are none, so state) Name none (Signature and title of editor, publisher, business manager, or owner) Wayne Green. 11. Extent and nature of circulation. Average no. copies each issue during preceding 12 months. Actual no. copies of single issue published near EST to filing date. A. Total No. of copies printed (Net Press Run) X,79431, Y,79600. B. Paid circulation 1. Sales through dealers and carriers, street vendors and counter sales. 2. Mail subscriptions X,77983, Y,78116. C. Total paid circulation X,77983, Y,78115. D. Free distribution by mail, carrier or other means. 1. Samples, complimentary, and other free copies X,225, Y,237. 2. Copies distributed to news agents, but not sold. E. Total distribution (Sum of C and D) X,78208, Y,78352. F. Office use, left-over, unaccounted, spoiled after printing. X,1223, Y,1248. G. Total (Sum of E & F – should equal net press run shown in A) X,79431, Y,79600. (Signature of editor, publisher, business manager, or owner). I certify that the statements made by me above are correct and complete. Signed, Wayne Green.

W2NSD/1 continued from page 4.

AVOIDING IRS DIFFICULTIES

In case there are some readers who have their own businesses, who someday may have their own businesses, or who know someone who has or may have his (or her) own business, I think I may have some advice worthy of note.

Number one. . .when you pick an accountant, be sure that he is experienced with taxes and with dealing with the IRS. Be *sure!* Remember that chances are that the only reason you have to pay for an accountant is to prepare your tax returns. Any reasonably good bookkeeper can do all of the accounting you'll need to run your business and have a fair idea of its shape.

The tax laws are so complex that it is impossible to even get two IRS agents to agree about them and the interpretations of them. We get just a taste of this with our wretched repeater regulations, where the best brains of hamdom are bewildered. Well, imagine that situation multiplied by several thousand times. The IRS continually holds schools to try and keep their agents up on the newest aspects of the rules, but there's no way. Now, if the people who are running the show can't agree on their own rules, how can the ordinary taxpaying businessman ever hope to cope with this morass? The answer is that he is a sitting duck, waiting to be knocked off by any IRS agent that happens to aim in his direction.

A good accountant with IRS tax experience can protect you from these cossacks. Remember that bunch of Russian gangsters who used to ride into a village and pillage it? If you have an accountant who understands how the IRS functions you will never ever have to face the agents and you will not have to face a judge either, unless you happen to be a political martyr, a mafia godfather, or a crook. . .or any two of that set.

The average businessman depends on his accountant to make sure that his bookkeeper does not get him and the business in trouble with the IRS. Since no one, not even the best IRS agent, can be positive about every expense made by the company or corporation and know for sure that some agent won't come along and declare it a personal expense, it is up to the accountant to guide the bookkeeper in this situation and to try and make sure that the client does not get in trouble. This is so involved that there is no possible way for a businessman to double check the accounts on this, he just has to depend on his accountant and bookkeeper.

Should an IRS audit ever materialize, the businessman depends on the accountant to take over and handle it. There should *never* be a time when he should have to talk with the agent.

It is odd, I think that even though the expense of an accounting firm is brought on almost entirely by the demands of the IRS, that a business can't take this expense off as a deduction. This is obviously inequitable. A routine IRS audit costs around $3000 in accounting fees. . .certainly *that* should be deductible! How come expenses which are forced by the government and not by the needs of the business itself can't be recovered?

They have some of the same problems with sales taxes, as I recall. Businesses have to collect these taxes for the state or city and bear the expense of collecting them and keeping the records involved. Hey, Ralph Nader, where *are* you?

If my memory serves, the whole business of income taxes is out in left field and has never been ordained by the Supreme Court. It got started around 1912 or so, with a miniscule tax and the promise that it was a short term thing which would be removed when the immediate need was over. The Court has avoided coming to grips with this tax, probably on the grounds that to overturn it at this date would be to overturn the country. The IRS has gotten too big even for the Supreme Court! There is little doubt that the Court would have to declare income taxes unconstitutional if they ever let the question arise, so they have to make sure that it doesn't come up. . .which they do by ignoring it.

TAXPAYER COMPLIANCE PROGRAM

The IRS is always looking to strike fear into the hearts of the taxpayers in order to scare them out of trying to avoid taxes. In addition to their well-oiled public relations staff, which turns out pro-IRS propaganda by the ton, they have a very scary policy which is called the "Taxpayer Compliance Program." They are secretive about this program, undoubtedly because if the public knew that they were throwing away money on such a thing the chances are there might be a taxpayer complaint of sizable proportions.

Despite federal laws which are most clear in the right of citizens to see such government manuals, the IRS rulebook regarding this program has been kept hidden away and even its existance has been denied by the IRS. One man has spent years trying to force the IRS to live up to the federal laws which should force them to let him see their published instruction manuals for agents.

The Taxpayer Compliance Program is an expensive one, but apparently is justifiable in the minds of the IRS heads. What they do is take a case where a small businessman is being given the shaft by a special agent and call in hundreds upon hundreds of witnesses to testify against him. They call in people from all over the country for even the smallest amounts. It might seem odd to the rational person for the IRS to fly someone from one coast to the other, pay their expenses for the trip and the hotel, all for a $5 expense. The bill could come to nearly $1000, and certainly would be no less than $500.

Why such extravagance? Well, firstly there is no one to control the IRS from such wasteful spending. Then there is the rationale that in the long run it is worth the money because the person who is brought in to testify will go home and tell all his friends, family and co-workers that they better damned well pay their taxes. This is supposed to justify almost anything in the way of expense.

Put yourself in the position of such a "witness." Let's say you are the circulation manager of a magazine in California. The IRS special agent comes to you one day and asks you to verify that a publisher did, in 1966, buy a subscription to your magazine, a one year subscription for $5. You check your records and say yes, this is true. Then the special agent returns in a few days with a sworn statement of this for you to sign. The next thing you hear is that you are to be ready to appear as a witness for the IRS in the prosecution and not to leave the country. Never mind that you have a trip to Tahiti that you've been getting ready for or a business trip to Japan, you're stuck. You can imagine what you'd think of the IRS *and* the publisher.

Hundreds upon hundreds of such "witnesses" are harrassed by the IRS in "cases" such as this. Some are threatened and intimidated, and many have been inconvenienced to a substantial extent. Just about all are scared and annoyed. The Taxpayer Compliance Program swings along. would bring a witness all the way across the country to testify to one magazine subscription for $5. The IRS special agent has decided that subscriptions to other magazines is not a business expense and thus has chalked it up as a personal expense of the head of the company. Has the special agent asked what the purpose of the magazine subscription was? No.

And how much tax is involved in a $5 disallowal? Well, that means that the taxpayer has $5 more in income – income not declared to the IRS – and if he is in the $12,000 range this would mean a tax of about $2.50.

Add to that the 50% penalty for not paying the tax, and you have $3.75. Then add 6% interest per year and you are up to $5.98 in tax due. Okay, the taxpayer is billed $5.98 for a $5 disallowed expense. . .but this still leaves the company owing too. Taking $5 off the expenses of the company means that the company earned $5 more than it reported. If the company is making a modest profit this undeclared income would be taxed at 50%, $2.50. . .plus the 50% penalty for it being unreported, plus 66% gives you another $5.98 due. Thus IRS is able to run up a tax bill of $11.96 when they disallow one $5 item.

That $11.96 doesn't even come close to the $1000 it costs to bring in the witness, but that is how the Taxpayer Compliance Program works.

TAX ACCOUNTANTS ARE HARD TO FIND

While 73 Magazine was based in New York we had no problem in having a fine tax accountant. . .one of the best. Then we moved to New Hampshire and looked around for someone with tax experience in the area, and could find no one.

One of the blacker days of 73's history was when our next door neighbor lost his job as head of the Guernsey association here in Peterborough and became the local representative of General Business Systems, a large national accounting firm. We got talked into using this service. Then, when the IRS agent arrived for an audit, the local rep deserted us and left us to handle the situation alone. This is absolutely unforgivable for an accountant. No client should *ever* have to deal with an IRS agent.

Word of wisdom: should this ever happen to you, run, do not walk, to a good tax accountant. Don't fool around. Don't for one minute think that just because you have been honest in every way that you can't have prison and shattering expenses ahead of you.

If you know of any business that is thinking in terms of using General Business Service, you might ask them to drop me a line and I'll tell them simply and factually how I go the run around.

We'll have more on the IRS next month. Move over, Nadar.

REPEATER APPLICATIONS

The news from the FCC is bleak indeed. It appears that all pretense of providing any sort of efficient service has gone out the window and groups figuring to put new repeaters on the air or to modify present repeaters are faced with incredible delays.

Some groups have met his bureaucratic bungle (Walker, we all told you this would happen if you insisted on the mountains of paperwork – and you denied that it could happen) by running repeaters on an informal basis without identification. Obviously no magazine can suggest that this is a good approach to the problem – but the fact is that there is no good approach to the problem.

There are reports of several groups that are just throwing the new rules to the winds – with one in the East now boasting almost 50 members, none using their calls over the repeater – shades of CB! We are seeing how one man has been able to get the destruction of an extremely valuable service started – cheers, Walker.

Many groups are groping with the new rules – rules which have frustrated the top minds in repeaters – trying to wend their way through the legal thickets toward that legal ticket. The ARRL has a form that may help – send a sase for the Repeater Station Application form. It's five pages long, so put on a couple stamps. That's ARRL, Newington CT 06111, in case you've lost their address or are not familiar with the outfit.

NO SAROC THIS YEAR

The Saroc convention was such a bomb last winter that we here at 73 vowed that we would pass it up this time. The whole thing consisted entirely of a few commercial exhibits as far as the "convention" was concerned, with virtually nothing planned for talks or forums. It was so blatently commercial that it made us sick. It was obvious that the whole thing was just a ruse to such hams into coming to Las Vegas to drop their money at the gambling tables.

Who needs it?

If the time comes when the ham going to Saroc is given a fair shake, then perhaps we'll come out again. But the show isn't even run by hams any more as far as we know. The last we heard the local hams wouldn't touch the "convention" with a ten foot pole.

For the price of a lost weekend in Los Vegas you can get quite a bit of ham gear and have fun for years instead of a few minutes. . .if that.

For two years running Saroc has been a bust. Few of the hams that came two years ago showed up last year – so who will be there this time? They're running out of suckers.

FCC EMPLOYEE DIES

Though the FCC denies the story, word has reached 73 Magazine that tragedy had struck the amateur division of the FCC in their Washington office. The death of the unnamed employee might have gone undiscovered except for an alert visitor from a repeater group in Iowa who insisted on finding out what had happened to his application for a license, about which nothing had been heard for several months.

The visitor was shown to the repeater application processing room and he began searching through the mountains of filings. Imagine his horror when he lifted one particularly heavy manuscript and discovered a withered hand showing in the gap!

One official remarked that some of the secretaries had thought it odd, but not without precedent that nothing had been in the outbasket of that department for several weeks.

The death triggered an immediate investigation of other nearby offices and, for a few moments it was feared that a second employee might have passed away, but the paycheck test turned out to be positive and everyone was relieved to find that the chap was merely asleep.

Since the normal working posture for so many of the people in that department is difficult to tell from sleeping, a good deal of caution is used in attempting to discover if an employee is working, sleeping or deceased. The best test discovered so far is the waving of a paycheck hear the employee. In most cases, even in deepest sleep, it will be grasped. This is not always a totally reliable test, for the reaction to a paycheck is so strong in some employees that even in death the hand will reach out.

REPEATER LICENSES

The latest reports from the FCC are that things are bogged down beyond all description. They have sorted out the mess into three big piles – the old applic tions for repeaters needing relicensing – new applications for repeater licenses – and modifications to present licenses. I gather that we are looking at a one to two year delay, unless some sort of basic changes, not yet in the works, are made.

It serves no useful purpose to stand around pointing a finger at Walker saying we told you so.

Hopefully the hearing in January will grease the shute so the new rules can be thrown out and further time and money by the FCC saved.

If the profusion of unneeded and discouraging limitations on repeaters is not thrown out, it could take a couple years to license a new repeater. The FCC admits to over 600 applications being on file!

NEW ENGLAND CONVENTION

There was good and there was bad. The weather turned out to be excellent, but since almost all of the action was inside, this was a plus that many convention goers missed.

It was a little difficult for some of the amateurs who were not among the wealthy elite to drive by motels with $8 off–season signs to go to the $28 a night Dunfey's. That was the special convention rate — it's even higher during the season!

The two dozen or so exhibitors had no serious complaints on the number of hams that turned up on the weekend. Some were grumbling quite a bit on Saturday, when it was surprisingly deserted — particularly those who had been to the Evans Radio Open House, which was really packed — and that was way up in Concord, New Hampshire the weekend before! The Sunday crowds were much better than expected, and made the trip worthwhile for most exhibitors.

The flea market was spotty, with only a handful of fleas present.

The hotel food was bad and incredibly expensive — which accounted for the large number of conventioneers walking around with Burger King food trays brought in from a couple blocks away. The chef at Dunfey's may be one of the world's great experts in removing the taste from virtually every type of food, while retaining its appearance. Perhaps soy bean food is here and can now be made to look like chicken, corn, and potatoes. Certainly chicken is here that can be made to taste like soy bean curds — or was it more like mongo beans?

Admittedly my nose was out of joint, and it would have been difficult for me to see things with any rosy glasses. This all started several months ago when I offered to set up the FM program for the convention — and my offer was accepted. Unfortunately the program chairman had not cleared this with Newington and Huntoon.

It didn't take long for the — er, fur, to fly and it ended with the program chairman having to call me and tell me that for the third New England convention in a row I would not be premitted to speak on any forum or at any banquet. The FM program was being taken over by Bruce Marcus and Gordon Pugh. This was somewhat of a disappointment, as you might imagine.

The fact is that I do not hold either of these amateurs in great esteem — and my reasons would fill a book. With some encouragement they *will* fill a book.

Since I had quite a bit of news to bring to the convention I was disappointed not to be able to speak. I wanted to tell them about the hearing Chairman Burch has arranged for us in January — about the further developments in Jordan — about possibilities for development of amateur radio in several other countries that has evolved from this pioneering thrust — and about late news in the fight to save the 220 MHz band.

So, instead of giving talks, I stood in my booth and sold subscriptions and listened to gripes from exhibitors. For some reason many o them were grumbling that little was selling — it was a different type of crowd from that bunch of buying fools that go to Dayton and pick every booth clean. Somehow the convention did not seem to bring out many of the active hams who are doing most of the buying these days.

Several new items were on display and drew a good deal of attention. Venus was showing their new slow scan equipment — which seems to work very well. Emergency Beacon was there with their new FM unit — the one which has everything built in that you can imagine. The $1000 ticket on it slowed some of us down, but we must remember that the difference between a man and a boy is the price of his toy. This will separate the me from the boys.

One of the convention attendees was Julian Sobin and his wife (of Sobin Chemical) and they are headed over to China again for another visit. I have hopes that they will be able to help open up an interest in amateur radio in China. I sent along a package of back issues of 73 to churn the water. Wouldn't it be wonderful if I could get over there and convince them to go the same route as Jordan! There is nothing that China could do that would be more helpful to them in opening up their country for development — communications is one of the most basic needs for the growth of any country — and this means people who understand communications — and how better to get them than through amateur radio?

On the strength of this opening I sat down and wrote a one page introduction to the importance of amateur radio, explaining the concept of growth through the development of communications — and the role that amateur radio plays in this — ending with the example of Jordan. Copies of this paper are available to anyone who has a good use for it. I suggest sending it with a covering letter to the officials of any emerging nation that you may personally know. Let's get this thing started! I stand ready to pack my toothbrush and go anywhere in the world where they are interested in getting amateur radio going — I'll show them how to go about it — write regulations fitted to their needs — and, if it will help, even set up a station or two — and perhaps a repeater.

Since the ARRL HQ went to so much trouble to screw me, many of the exhibitors seemed to feel that I should be the center of their complaints about the convention — so I got an earfull of the miseries they were having — such as an almost utter lack of cooperation on the part of the hotel in supplying electricity for some exhibits — ceiling lights that were out and darkened some of the exhibits — electricians apparently explained that they had been out for a couple years and nothing could be done — the high charges for stored boxes — Collins had a bill for $15 just for storage! — and the odd layout which put some of the exhibits way back in a corner where few convention goers ever found them. I wase't surprised at all to find the 73 booth back there — I think we got perhaps a hundred amateurs who managed to find the out of the way corner on Saturday — on Sunday morning we moved the damned tables out of that booth and up front by the entrance where we could at least be seen.

In talks with Frank Warnock of the Dayton group, I suggested that next year the Dayton committee have a group of amateurs watch the parking lots of the major motels to try and prevent the thefts of mobile rigs and antennas which marred the Dayton Hamvention this year. The New England convention could sue some of the same. I was more than a little upset to come out of the hotel on Saturday and find that my two meter antenna had been stolen from the car. Several other amateurs had similar complaints, and some apparently lost complete mobile setups. A watch from about 11 pm until 7 am would be easy to arrange, and would be a valuable service to everyone but the manufacturers and distributors of antennas.

Keith spent a good deal of the convention flying around in his plane with the Clegg 220 repeater in it, helping new 220 repeater records to be set. The amateurs down in Lancaster (PA) were able to work through the repeater all the way up to Providence (RI)! It is obvious that a plane is the proper place for a repeater.

About the only real sour notes were comments from the two darlings of the League HQ, Marcus and Dana, who put most CBers to shame with their vile language. It is disgusting to hear a League official talk over the air using language like that. Many of us look to League officials to set a good example on the air and are deeply disturbed to hear otherwise. With the exception of the temporary 19/79 repeater, two meters was well repre-

sented. The main repeater set up was the Derry NH group WR1ABQ on 25/85, with an assist from the WR1ABV 04/64 group from Waltham. The 07/67 WA1MHN group put on a whale of a party. And so it went.

The Clegg exhibit was a point of major interest, with the new 220 repeater being shown and the club purchase plan being explained. This is a clever system whereby a club can buy the repeater on time, and the payments grow smaller as more and more of the club members buy Clegg 21 transceivers to use with the system.

Several clubs have gotten started with this ingenious system already and are pioneering on 220 MHz. Operation up there is a dream — no interference — and the range seems to be even better than two meters in most cases. In areas where there are too many two meter repeaters, this would seem like a good way to go. There is also the element of sharing in the development of this relatively unused band — the pride of knowing that you are in there doing something — and having fun to boot.

NIKON SCHOOL

Nikon has organized a few teams of experts who go around the country giving two day short courses in photography, with the emphasis on Nikon cameras. I finally managed to get together with one of these in October and found it most valuable. Unfortunately, now I have a serious need for a lot of equipment that I never knew I needed before. I wonder if any readers have some Nikon accessories they might want to swap for a subscription to 73 or modest amounts of money? I'm needing such things as the No.4 bellows, the No.4 slide copier, any of the filters, extension ring K set, BR2 ring, BR3 ring — things like that.

In the past I have visited many clubs, bringing along my slides of one or two countries and showing them. With a slide copier I can see where I could make some good copies and thus have slide programs to lend out with a cassette tape commentary for club meetings that I can't get to. My programs on 5Z4 — ET — SU — JY — OD — YK — YI — YA — VU — XZ — HS — 9V — FK — VR2 — 5W1 — KS6 — KC4 — VP9 — VP7 — 5B4 and a few other might be interesting.

A recent poll indicated that about one third of the 73 readers are into photography as a second hobby — so the Nikon school may be of interest when it comes your way. Zeus knows we need better pictures to go with articles and it is a rare month indeed when we have anything usable on hand for a cover, despite our requests for good cover pictures.

OCEANUS CALLS

One of the newest "countries" of the world is Oceanus — and it is also by far the largest country of the world. Oceanus comprises all of the oceans of the world outside of the three mile limits of land.

For some odd reason the oceans of the world have never been claimed as territory, even though they are all underlaid with ground as solid as that above the water. In early days the limits of land territory went to the water's edge. Then this was extended to a three mile limit. Recently some countries have decided that their territories go out to a 12 mile limit — and even a 200 mile limit has been claimed by some countries who are into protecting the fishing rights.

But as the development of the oceans progresses, with oil wells being drilled many miles out at sea, and other minerals becoming practical to mine at sea, the concept of the sea as territory will evolve.

Oceanus has set up a government of the oceans of the world — with a constitution similar to that of the United States, and is hoping to achieve recognition of the ownership of the oceans in the name of all mankind. A bill is now in the Senate to have the U.S. recognize Oceanus and feelers are out to several other nations of the world. The advantages to the land-locked countries is obvious — they would have a share in the oceans which otherwise would be denied them — and since the oceans may one day be a major part of the wealth of the world, it would be almost foolish to turn down an opportunity to invest in this concept.

One immediate goal of the Oceanus government is to keep the oceans clean for the future — to bring spoilers of the ocean to court — to insist that oil spills be cleaned up — that new wells be drilled only when there is a surity that no oil will be spilled that will not be cleaned up — that endangered species of ocean life will be protected.

Oceanus has set up a system of registering ships and there are some advantages to registering vessels under the Oceanus registry. This does not prevent dual registration under any other country's flag, of course.

Amateurs operating aboard Oceanus registered vessles may be interested in applying for an Oceanus call. Calls starting with the single letter "O" will be issued to amateurs holding valid amateur licenses issued by other governments. The ITU has been notified of this.

Citizenship in Oceanus is open to the citizens of any other country and does not in any way affect prior citizenship. Dual citizenship is common these days. Citizens of Oceanus will be issued an Oceanus passport.

Getting an Oceanus License

In order to get an Oceanus amateur radio license you must be a citizen of Oceanus — which is included in the license fee. Send a statement as follows, "I wish to be enroled as an Oceanus citizen, not to supercede my previous citizenship committments." Please state your present citizenship, furnish a copy of your presently valid amateur license, and include $5 in U.S. funds or the foreign equivalent.

Send this to Oceanus, Office of Telecommunications, 73 Magazine Street, Peterborough NH 03458. Please make the check out to Oceanus.

Calls will be issued starting with O1AA and progressing to OØZZ.

GOING FIRST CLASS

The Emergency Beacon ad for their new superfantastic two meter rig got me to thinking about my philosophy of cheapskating my way through life. By making do with the least expensive way of getting on different bands I suspect that I've missed a lot of fun that I might have had.

Building is fun, and converting surplus is fun too, but perhaps I would have gotten a bit more out of amateur radio if I had prusued those aspects of the hobby for themselves rather than as a way to save money. On the other hand, perhaps, if I'd gone the first class route, I might not have had the drive to build and convert, and I might have missed a lot.

Back in 1965 I got fed up with making do with this and that and decided to go first class for once. Well, perhaps not truly first class, but certainly a high second class. I put up a full sized three element twenty meter beam — a brand new transceiver — and a Henry 2K — 70 foot tower — and I got busy on 20m and had a ball. Compared to other hobbies the investment was very modest, perhaps $1200 for the works. That won't take you far in sports cars or planes — or boats.

The signal was first class, and able to get through most pileups(except over Asia way where big trees shield the signal). The result of my big investment in 1965 was that I've had nine beautiful years of being able to work DX. I'm not a big country hunter, but I've worked 100 in one weekend, just to prove that it can be done — and I'm somewhere over 300 total. Not being a certificate fiend, I haven't counted them up for a couple of years.

Going first class has not seemed to substantially dent my enthusiam for building and playing around with new gadgets. I've had a lot of fun with

Caveat Emptor?

Price – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

We cannot check into each advertiser, so Caveat Emptor . . .

DISCOUNT PRICES plus full warranty, call or write for fast quote on new radios and accessories. SBE144 199.95; Midland 13500 219.95; 13520 W-T 209.95; 20% plus discount off list price Hygain, Mosley; TH6DXX 143.00; Classic 33 124.00; 15% plus discount off list Triex, Rohn, Standard, Collins, Clegg FM 27B 479.00 list; Drake, Swan, Tentec: Write tradein prices. Ham-M 99.00; TR44 59.95; Belden 8448 rotor cable .10/ft; 8214 RG8 foam .17/ft; Motorola HEP170 epoxy diode 2.5A/1000PIV .29, 25.00/1000 lot; Calrad KW SWR-relative power dualmeter bridge 15.95; Free flyer. Shipping charges collect. All items guaranteed. Madison Electronics, 1508 McKinney, Houston TX 77002. (713)224-2668. Nite/weekend (713)497-5683.

GOING TO SCHOOL, must sell following gear: Deluxe Clegg 6m SSB receiver, only $230, with power supply. Heathkit twoer, A-1 condition, only $30. Conar 25 watt CW transmitter, only $15. Heathkit DX-60 it, not assembled, parts missing, only $30. You pay shipping. Write: S. Couch WBØGAR, 1815 Princeton, Ottawa KS 66067.

GONSET G-50 6m Communicator, 6 element Cushcraft 6m beam. Best offer. Mort Cohen WA2ARS, 3 Elk Lane, Centereach NY (516)928-2673.

FREE BOOK about Digital Logic and Computers, and how you can design and build your own. EEW, Box 8204-BC, Pittsburgh PA 15217.

SB-34 SIDEBAND TRANSCEIVER 75-15m, built in AC/DC supplies plus never used mobile mount. Total operating time on rig near 20 hrs., almost brand new! Sorry, no microphone. $225. Ron Subka WA9FPP/1, Russell Station Rd., Francestown NH 03043.

EQUIPMENT FROM 73

The following list of gear, unless otherwise noted, consists of brand new equipment purchased for testing purposes only. Some have been tested, some remain unopened in original cartons. We are offering this gear at a considerable discount on a first-come-first-served basis. Please send Money Orders or Certified Checks only to 73 Magazine, Peterborough NH 03458.

Cap-Com 40m solid state SSB xcvr	$150
Heath IB-101 counter with Vanguard Scaler	$250
Clegg 27B 2m xcvr	$380
IC-22 2m FM xcvr	$246
Midland 13500 2m xcvr	$200
Midland 13509 220 xcvr	$200
Tempo CL-220 220 xcvr	$200
Clegg FM-21 220 xcvr	$255
Regency HR-6 6m xcvr	$190
HR2MS 8 channel scanning 2m xcvr	$255
TME-H-LMU 16 channel rcvr	$255
Digital Logiclocks	$ 80
Dycom 2m repeater	$425
Wilson 7 element 10 & 15m beam (pick-up only)	$250
Waller 60A power supply	$105
Standard sr-c 120/5 power sup.	$ 44
Gladding 12V power supply	$ 60
SBE Scannavision	$650
Robot Monitor	$265
Robot Camera	$265
AX 190 amateur rcvr	$200
SX 190 SWL rcvr	$200
Pickering KB-1 keyboard	$200
TPL 502-B 2m Amp 1w/40w	$110
TPL 502 2m Amp 10w/45w	$ 90
Heath HW-202 w/encoder	$180
Heath HWA-202-1	$ 30
Heath HA-2022 amplifier	$ 70
Gladding 8 channel scanner	$110
Gladding HI-Scan	$150
Regency TMR-8-U Scanner	$140
Tempo fmh charger	
Heath HM-2102 wattmeter	$ 30
GTX-2 FM xcvr	$225
Newsom 2m KW amplifier	$350
Temp-ONE SSB xcvr	$275
External VFO	$ 80
AC-One power supply	$ 80
FPM 300 SSB xcvr	$480
Heath IC-2009 calculator	$ 90
SBE 450 FM xcvr	$340
MITS calculater w/ac adaptor and case	$130
Memory-Matic 8000	$320

GENERAL ELECTRIC VOICE COMMANDER III solid state 1 watt 2m portable. Excellent condition w/nicad batteries, charger, leather case, strap and remote mic. Complete GE data file included $90 ppd. 2 ea. GE MT-33 transistor powered prog. 30 watt 2m mint cond. with dusty accessories $90 ea. Complete GE Mastr pro. 70 watt 450 MHz. mobile minus basket, Morotola Motrac 50 watt 6m U51HHT with PL. Looking for Motorola Motrac and Motran 450 MHz. Write with your needs, will trade. John Thornton, 12585 Jones Bar Road, Nevada City CA 95959.

DRAKE R4B: Absolutely MINT! Proof of recent factory alignment – $335. Galaxy Mark II, A.C. Supply, Remote VFO, VOX, Clock-Phone Patch Console, Mike – $375. Bill Handel K8SSY/6, 750 Stierlin Rd. Apt. 131, Mountain View CA 94043. (415)-965-2691.

ENHANCE, FRAME & ORGANIZE your QSL cards with 20 pocket plastic holders. Two for $1, seven for $3, prepaid-guaranteed. TEPABCO, Box 198M, Gallatin TN 37066.

JEHOVAH'S WITNESSES WHO ARE AMATEURS Please write: Bob Ellis WA4UQQ, 160 Lagoon Road SE, Winter Haven FL 33880, or call 813-293-3595.

STANDARD SRC-826M 2M FM Transceiver with Newtronics mobile collinear. 52-52 & 16-76 added. $275. Lawrence Rachman WA2BUX, 2 Maggio Lane, Old Bethpage NY 11804 (516) 694-3487.

FREE with the purchase of a new Genave GTX-200 at $259.95: 18 crystals of your choice. Send cashier's check or money order for same-day shipment. For equally good deals on Drake, Standard, Clegg, Regency, Midland, Hallicrafters, Tempo, Kenwood, Ten-Tec, Galaxy, Hy-Gain, CushCraft, Mosley, Sony, and Hustler, write to Hoosier Electronics, your ham headquarters in the heart of the Midwest. Become one of our many happy and satisfied customers. Write or call today for our low quote and try our individual, personal service. Hoosier Electronics, Inc., RR25, Box 403, Terre Haute IN 47802. (812)894-2397.

FOR SALE: Motorola, G.E., RCA FM mobiles. Hammarlund HX 500 and HQ 170A. 3 in. refracting telescope. Radio magazines back 25 years. SASE for details. W9DGV, 2210-30th Street, Rock Island IL 61201.

TOUCHTONE: Aeco receiver with schematics, $50; desktop pads with cases, $20; Trimline TT phones complete, $25; keyboards, oscillators $8 ea; Genl. Radio slotted line type 874-LBA, with stubs, adj. lines, etc., $150. Mod 19, synch, with CV-89A TU, $100. Repairs and engrg. info on Automatic Electric Co. eqpt. Swaps invited, want 2m base station, Mod 14 typing reperf. Doug WA1QEV, 3 Hall Ave., Nashua NH 03060.

SWAN CYGNET 270B 10-80M transceiver. Mint condition 1 1/2 years old. Call or write WA1QLK 15 Greenough St., Brookline MA 02146. (617)734-0661 Asking $390.

R-390A. Clean, good condition electrically, mechanically. $456. Includes crating and shipping. W6ME, 4178 Chasin Street, Oceanside CA 92054.

STEAL THIS EQUIPMENT MOVING — Must sell Mosley TA-33 Senior, Mosley 14 AVQ vertical, Cushcraft 11-element 2m beam, Motorola W43GGV mobile transceiver, Motorola base transceiver, Superex APS headphones, Hallicrafters SR-42A 2m transceiver, Heath IG-10 color generator, Terado 275 watt inverter (never used), Elco oscilloscope, Drake MS-4, TR-44 rotor, make offer on any or all. Will ship. Bob, 30 Sunset Blvd. Massapequa NY 11758.

TRADE: SB-33 15 to 75mtrs. Transceiver with mobile supply, for 2m FM transceiver. NYC area only. S. Kraman 941-8780. After 7:00 PM.

SURPLUS TEST EQUIPMENT, VHF and microwave gear, new and used, checked for operation. Send for bulletins. David Edsall WA4EZM/3, 2843 St. Paul, Baltimore MD 21218.

TECH MANUALS — for government surplus gear $6.50 each: WRM-25D, TT-63a/FGC, TS-382D/U, R-389/URR, R-390/URR, R-220/URR, R-274/FRR, BC-610, URM-32, ALR-5. W3IHD, 7218 Roanne Drive, Washington DC 20021.

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SWAN 600R CUSTOM SS-16 with CW filter, 600T, 600SP. One year old, $800. Mike Sullivan 535 Eagleview Ct., Zionsville IN 46077, call evenings (317)873-3225.

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MONITOR POLICE/FIRE Dispatchers! Catalog shows official directories of channels, nationwide. Use with CD, MARS, RACES, etc., work. Send No. 10 SASE. Communications, Box 56-W, Commack NY 11725.

FREE! FREE! FREE! We'll ship you your choice of a base or mobile antenna from our nationally famous manufactuer when you purchase your new Regency ham rig at our regular price. AR-2, $119; HR-2B, $229; HR-220, $239; HR-6, $239; HR-212, $259; HR-2MS, $319. Enclose check or money order...we pay shipping...NO COD. Marine Radio? Write for free catalog. Great River Radio, Box 65, West Burlington IA 52655.

FOR SALE, Motorola L41GGB 6m base station on 52.525, immaculate cond., also J57AAB 60 watt 2m base station or 37/97 with remote control panel in 4 1/2 inch outdoor cabinet. 125 each or trade for 2m diplexer. W8HEE, 140 Ash, Whitmore Lake MI 48189.

RTTY, with slow scan, and things like that. It has made it so I could sit and talk with friends around the world with a lot less interference problems.

On two meters I've gone about the same route. I started off with jury—rigged gear and eventually went the first class route — and have been thankful ever since I made the change. I run a 22—channel rig with a nice TPL 130 watt amplifier — and I work out extremely well. You can be sure that I'll be getting a synthesized rig as soon as they are available in quantity...and I can find one that fits my car. I wonder if I can fit one of those EBC rigs in there...?

Going first class costs a little more, but the extra fun involved seems to more than make up for the little more per day that it costs. I will always remember an old buddy of mine who used to have the motto, "For a few cents extra you can go first class."

DESPITE WALKER'S —

Promise to throw out any petitions for repeater rule changes, made to the group at Rochester, the McCoy wing of the ARRL is working on another attempt to get Walker to back down via the petition route. In view of the upcoming hearing before the Commissioners in January, this might be a way to take some of the hear off for Walker.

The ARRL petition is a compromise affair, asking for some needed changes, but falling far short of asking for what is really important: freedom from restrictive regulations which have no real purpose. For instance, they will ask that the repeater channels be considered for repeater use and the Walker concept of simplex use forcing a repeater to shut down be given a proper burial. They would like to have the antenna patterns deleted. They want repeaters to be able to make changes without prior approval by Walker — which could save a year or two at the present snail's pace of the FCC. They want no limit to the number of control operators — there was no limit set in the regulations, only in the Walker interpretations. They want crossband — and so does everyone else. Walker gets livid when this is brought up. Repeaters should be linked as desired. They would like an increase in 6m power allowance — I'd like to see all power limitations taken off other than our basic mandate of one kilowatt.

The ARRL is going to ask for control on the same channel — and, if there is any real question about economy of channels, this makes sense. It can be done quite effectively, so why require a 450 link? They also want any kind of control legalized — our responsibility should be to control the repeater in the best way for each of us — and it's none of the FCC's business how we do it, whether it be by direct control, wire line, link, etc.

Since the FCC demanded maps are not available for all parts of the country they are going to ask that substitute maps be accepted. Nuts, sez I, why should we have to submit any map at all? The FCC isn't setting up our repeaters like FM stations, so this is a complete waste of our time and money and to no possible purpose.

My own idea is that we should ask the Commission to throw out all of the restrictions set up in docket 18803. Most of these objectionable rules were set up to help us avoid future problems which Walker imagined we might encounter. Since he apparently was not well versed on our present state of the repeater art, it is not surprising that his crystal ball was pretty cloudy.

GALLOWS HUMOR

For some odd reason the FCC decided to set up an exhibit at the convention in Reston, VA, in September. The exhibit arrived in three huge packing crates stenciled "Property of the FCC," to which someone had added to one of them, "Repeater Rules, Box one of three."

FILING REPEATER MODS

You may be able to save a year or more on getting modifications to your repeater license accepted if you remember that the intention of the Walkergroup is to throw out your old application forms and replace them with the new ones. So make sure that you essentially resubmit your whole

filing with each modification, whether it be for a different antenna, a change in type of coax or length of coax to the antenna, location of the repeater (Walker refuses to officially establish an interpretation of the rules on this, so even a one foot move of the antenna could call for a modified license), means of control, power, etc.

SOMETHING TO TALK ABOUT!

Though one would be hard put to discover this from a casual tune around the amateur bands, there actually are other things to talk about than signal reports, the equipment being used to talk about the equipment, and the weather.

For instance there are wonderful possibilities in the newer FCC regulations and the proposed changes in rules. Many operators need a dozen or two good contacts to build up the level of outrage needed to properly answer the FCC's proposal to open a new citizen's band. This is so preposterous that many of us tend to just try and ignore it — like some terrible calamity that we refuse to really face. Perhaps if we talk about these things over the air a bit they will become real enough so we can sit down and do them justice in our comments to the Commission.

But there are other things to mull over too. Mutual indignation contacts are okay now and then, but they make a lousy steady diet.

Now, to get around to the point (for a change) — there are some pocketbooks around that are most fascinating and which have so much incredible data in them that you should be able to stop any roundtable flat in seconds. One of the best of the breed is a Dell book, "Mysteries From Forgotten Worlds," which is Dell 6214 and costs $1.25. Another excellent book of the gendre is, "We Are Not The First," Bantam Q7534, $1.25, by Tomas. If this begins to get to you, you may want to get back to the first of this series, books by Daniken, Bantam Q5753, $1.25, "Chariots of the Gods?" — which was featured in the television special "In Search of Ancient Astronauts," and Bantam Q7276, $1.25, "Gods From Outer Space."

These books introduce you to interpretations of ancient texts and archaeological findings which suggest strongly that there may have been some previous civilizations that were quite a bit more advanced than we have hitherto suspected.

One example which several of the books discuss is the Piri Reis maps, recently discovered in the Topkapi musuem in Istanbul, and which apparently were copied from maps that Columbus used on his trip — which were in turn copied from much earlier maps. The interesting thing is that the maps show the Americas in good detail, including remote reaches of South American rivers — and, most astounding of all, the Antarctic continent is shown correctly as it would be without the layer of ice which is thousands of feet deep!

By way of a short check on the material in the books above, I called Father Lineham W1HWK, the head of the Weston Observatory and an old friend, to ask him about the Reis maps. He had worked with them a few years back and was quite familiar with them. He substantiated that the maps did indeed show Antarctica as it would be without the ice coverage — and he pointed out that the ice is not hundreds of years old, as reported in books, but is millions of years old.

The Father pointed out that the Reis maps show Greenland as three separate islands, a fact only recently discovered by echo sounding of the millions of years old icecap. He also affirmed that there is good reason to believe that Columbus had indeed used predecessors of the Reis map.

If the other reports in the books are even half as accurate as the Reis map story, then there is a lot to think about. It would only spoil it for you to tell you about discoveries of 2000 year old batteries, an intricate computer of about the same age, precise calculations of the circumference of the earth dated 300 BC, and things like that. Have fun — and start boggling minds on the air a bit.

RECENT CONVENTIONS

The *Hamburg* Hamfest was a real winner this year — the manufacturers who exhibited there got all the attention they could ask — and then some. Watch out for an even bigger affair next year — and don't pass up this new and growing hamfest. It is a fact that you'll get better treatment here and more personal attention than at any other hamfest.

Dayton is going a full weekend in 1974 — and that's great news. The committee expects that they may pull in over 8000 this time, setting an all—time record. Dayton has the largest exhibition area — the largest flea market — the largest attendance.

Hyannis came off about as predicted. The Saturday turnout was a little thin, but Sunday was better than in the past and made up a bit for it. The exhibit area irritated a lot of the exhibitors — troubles with getting power — trouble with lights — trouble in bad locations of booths — trouble finding anyone to help with problems — exhorbitant storage fees for boxes shipped ahead — things like that. Distributors were disappointed as few amateurs appeared to have brought any money — there seems to be some problem with this. . .many of the staunch ARRL members apparently are not active hams and are uninterested in buying anything. Odd.

Reston Virginia was a frost according to reports. The turnout was very thin and exhibitors needed a deck of cards to keep busy. The high spot of the convention was a sign on one of the three huge crates that were part of the FCC exhibit, "Repeater Regulations, Box 1 of 3."

Saroc 1974 — is anyone going? Almost all the manufacturers we've talked with are planning on passing up this bomb.

MORE COUNTRIES?

Should contacts with a country count as long as we are certain that the station really is in the country claimed? ARRL has long had this thing about not accepting clandestine operation, even though there was no question about it being where claimed. I recall one instance wherein the League almost destroyed an Iron Curtain country ham by sending a card back to the officials asking if it were okay.

For instance — Turkey. At present there are a few hams there — and in recent years there has at times been a good deal of clandestine operation there, complete with QSL managers. Should these cards be counted for awards and certificates? What do you think?

FCC HEEL DRAGGING

A visiting foreign amateur managed to get a reciprocal license, but it took him three long months of hard work to get it through the FCC in Washington. Apparently the Commission is not only bogged down on repeater licenses, but on other apsects of amateur license processing too. If Walker would spend a little time trying to get his department moving and being constructive instead of making one hassle after another for us, ridiculous delays like this might be avoided.

MORE SALES HELP

If you just look at the number of ads in this issue of 73 you can see why more people are needed in the 73 advertising department. We hope that there are one or two amateurs who might be interested in working at this. Sales experience is important, of course. Living in New Hampshire is great, so give us a call if you think you might be able to handle the job.

. . . WAYNE

Hallicrafters' all-american made FPM-300, Mark II "Safari" SSB/CW transceiver is Q5... from the Mauritania solar eclipse expeditions to a famous raft adventure in the Atlantic.

Proven design in the tradition of the HT-37 and solid-state dependability are combined in this compact transceiver featuring state-of-the-art FET's, hot carrier diodes and bi-polar transistors for peak, reliable performance for only $625.

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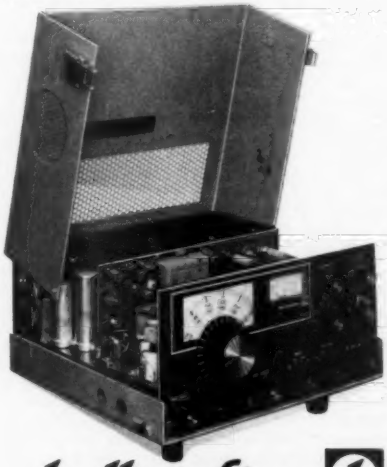
- Type of service: continuous operation with 2-tone S SB-CW-RTTY (50% duty cycle)
- Power Output: 125 Watts P.E.P. (Nominal) into 50 ohms
- Receiver Sensitivity: Less than 1 uV for 15 db SN Ratio
- Selectivity: 2.0 kHz
- Receiver IM: 60 db below 2 equal 10MV signals
- Receiver Image and IF Rejection: Greater than 60 db.
- Internal Receiver Spurious: Less than equivalent 1 Microvolt Signal
- Transmitter IM: 30 db below P.E.P. (26db below one of two equal tones)
- Adjacent Channel Desensitizing: 3 db with greater than 10,000 MV
- Sideband Suppression: -50 db minimum @ 1 kHz
- AF Power Output: 2 watts
- Stability: 100 Hz after warmup. Max. 100 with 10% line voltage change
- Frequency Readout: Within 1 kHz ± 100 kHz of Cal. Point not more than 3 kHz across entire 500 KC Band
- Break-In CW: Semi-Automatic
- CW Sidetone
- Audio Frequency Response: 500-2500 Hz Nominal
- AALC: 12 db Compression
- AGC Figure of Merit: 60 db minimum
- Crystal Calibrator: Provides 25 kHz Calibration Signals
- Optional Accessories: MR-300 Mobile Installation Kit; HA-60 Blower Fan Kit, works on AC or 12VDC



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CODE SPEED DISPLAY

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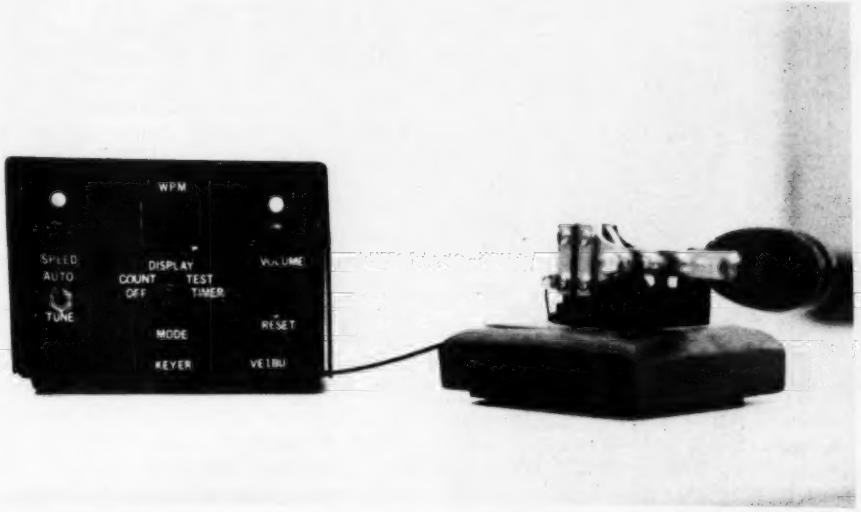


The first acquaintance with semiconductors for many hams came through the building of an electronic keyer. This gave the ham a chance to experiment and learn with a fairly simple and non-critical circuit. With the advent of integrated circuits (IC's), the same thing happened all over again. The natural circuit for application of these IC's for the ham was again the keyer. The first IC's were digital, either on or off and were easily adapted to the on/off characteristic of code.

Now that many hams have a keyer, it may be time to add an extra goodie to it. This article describes a circuit made up of a few IC's that displays your sending speed in words per minute. Halfway between a speed marked 5 and 15 on your keyer, never did mean 10 wpm. Now you can really know your sending speed and impress the neighbors with this new gadget in your ham shack.

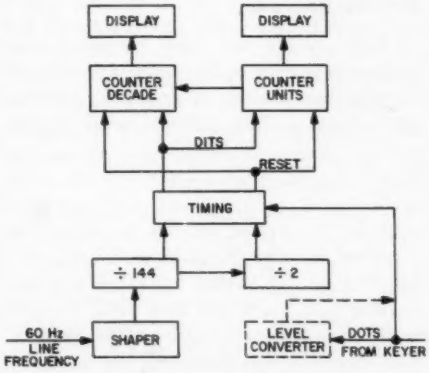


Fig. 1. Block diagram of the code speed display.

Block Diagram

The ARRL Handbook gives a formula for calculating code speed.

$$\text{Speed (wpm)} = \frac{\text{dots/min.}}{25}$$

or Speed (wpm) = dots/2.4 sec.

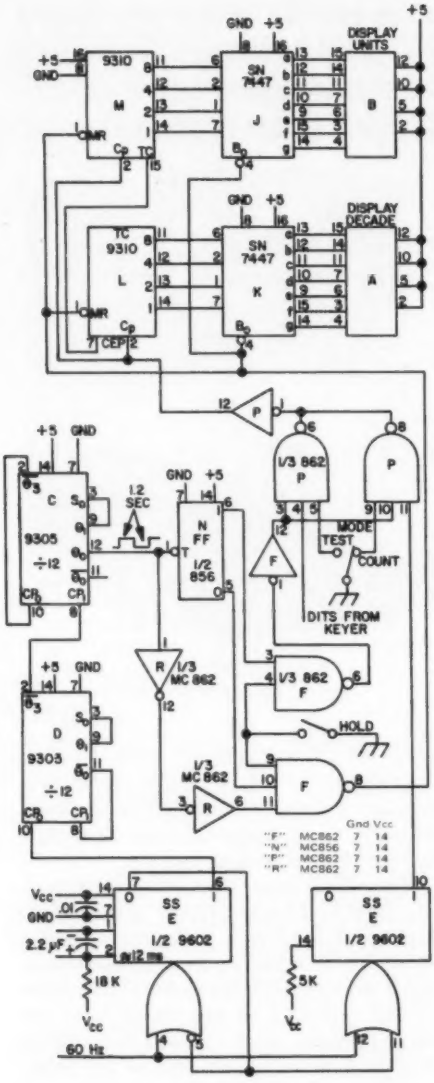


Fig. 2. Schematic of the display.

Consequently, if we can develop a pulse precisely 2.4 seconds long, and use this pulse to let dots from the keyer count-up a counter, then display the contents of the counter, we will have accomplished our goal.

A block diagram of the code speed display unit is shown in Fig.1. The source of the timing is the 60Hz from the ac line. A filament transformer steps down the voltage and the shaper prevents the noise that may be present on the ac line from producing false trigger pulses. The 60 Hz is then divided by 144 which yields a pulse each 2.4 seconds. This pulse goes to a flip–flop which develops a positive pulse for 2.4 seconds. The positive pulse enables a gate which lets dots to the counter. The timing circuit also resets the counter and enables the circuit to operate without manual reset. The counter is made up of two decode counters which enable it to count to 99. The decode counter outputs go to a binary coded decimal (BCD) to seven segment decoder which in turn drives the display.

This description will give those with a knowledge of digital circuit techniques sufficient ideas to get going and build the circuit with their own variation of components. However, for those without too much experience, the design will be reviewed.

Circuit Description

Fig. 2 is the schematic of the code display unit. The shaper uses a Fairchild 9602 single shot. When pin 4 receives a voltage greater than 1.2 but less than 5V, a pulse appears at pin 6. The width of the pulse at pin 6 is determined by the RC combination. With pin 7 fed back to pin 5, the single shot is inhibited from putting out another pulse even with noise on the line, until the pulse at pin 7 has gone away.

The period of the incoming line frequency is 16.6 milliseconds. The RC time constant was chosen to produce a pulse at pin 6 equal to 12 ms, this will insure that the

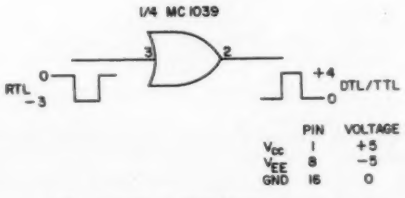
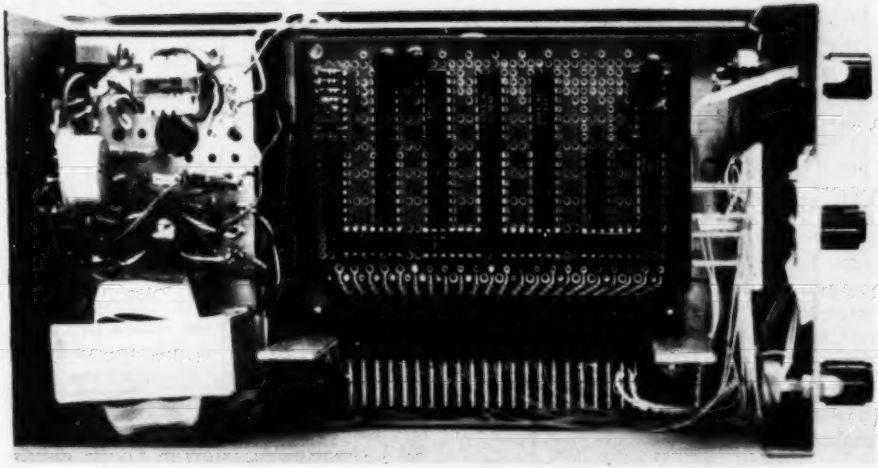


Fig. 3. RTL to DTL/TTL Converter.



Top view of the code speed display that was incorporated into the author's keyer.

pulse has gone away by the time the next ac line cycle appears. The shaper therefore, puts out a 12 ms pulse for each cycle of the ac line. When making a voltage divider for the filament transformer, use peak voltage for the calculation to inusre that voltage peaks at the shaper input never exceeds 5V. The pulses on pin 7 will be the same as those on pin 6 only inverted in phase.

Divider

The Fairchild 9305 IC can be wired to divide by various numbers, the IC's used in this application are wired to divide by 12. Hence two such circuits divide the incoming line frequency by 144, which results in a pulse at pin 12 of IC "C" each 2.4 seconds. This pulse train goes to pin 1 of Flip-Flop "N" to yield a pulse at pin 6 of "N" which is positive for 2.4 seconds and negative for 2.4 seconds. The same inverted sequence appears at pin 5 of "N." With the Hold switch open as shown, the 2.4 second pulse appears at the output of inverter "F" pin 12. We now have the 2.4 second gating pulse at "P" pin 3 and 10. With the switch in the COUNT Position, dots from the keyer pass through the gate during the 2.4 seconds and cause the units and decode counters to count the dots. The number contained in the counters is then decoded by the J and K IC's to drive the seven segmented display. After displaying the wpm for 1.2 seconds, the counters are reset and the cycle begins over again. Once the count has been made and displayed, it may be held by closing the HOLD switch. With the HOLD switch closed, the gating pulse and reset pulse are blocked and the display remains constant.

Test

This circuit contains a built in test feature which is an asset for those who lack the necessary test equipment. With the HOLD switch open and the MODE switch in the TEST position, the line frequency pulses from single shop "E" pin 10 are steered to the counters for a period of 2.4 seconds. These pulses substitute for the dots. There

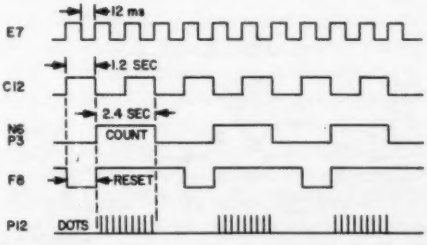


Fig. 4. Timing.

are 144 line frequency pulses per 2.4 seconds. Therefore, when the gate is enabled for 2.4 seconds, 144 pulses will enter the counters. The counters are only capable of counting up to 99, then they go to zero and continue to count incoming pulses. In this case, the counters will overflow and display 44. Consequently, a count of 44 in the TEST MODE indicates a good working unit.

Logic Levels

This unit is made up of TTL and DTL logic families. These logic families require positive (0 to 5V) input levels with a threshold of about 1.2V when the logic switches. Many keyers have been made using the RTL logic family. If your keyer is of this family and developes pulses which go from 0 to around -3V the above circuit will not work. Don't despair, with one more IC the 0 to −3V pulse can be converted to a respectable 0 to 5V pulse. The circuit for this level conversion is shown in Fig. 3.

Timing

Fig. 4 gives all the timing for the code speed display unit. The reset pulse comes just before the count begins. Evidence of the reset pulse can be seen since it blanks the displays during the reset period.

Power Supply

A word of caution to those who would rob power from their keyer to power the code speed display unit. This circuit requires 400 mA at 5V, so make sure your existing supply can handle this new load. If it can't, you can build the one shown in Fig. 5.

Operation

The best way to set your desired code speed is to adjust the speed with the transmitter off (no rf) then switch to HOLD and continuously display the wpm until you want to make another code speed change.

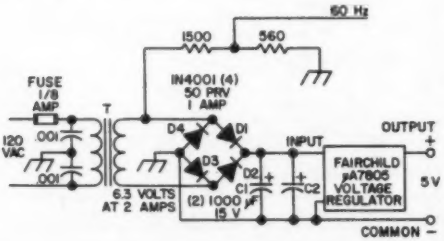


Fig. 5. 5 Volt Power Supply.

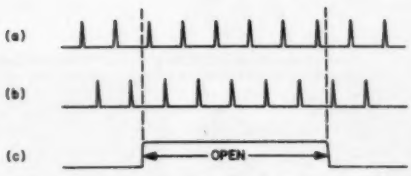


Fig. 6. Gating Error.

One thing to remember when using digital counters, whether it be this one or a frequency counter, is that the least significant bit may be incorrect by one unit. Since the opening and closing of the count gate is rarely synchronized with the dots passing through the gate, there always exists a ±1 count gating error. In Fig. 6, line (c) represents the opening of the signal gate. If the phase relationship of the incoming dots with respect to the gate is as shown in (a), six pulses will be counted. If, however, the phase relation is as shown in (b) only five pulses will get through the open count gate. If the dots from your keyer were derived from the line frequency, this would not occur.

Conclusion

Although a specific design was presented, the main objective was to present a way of measuring and displaying code speed. It is not important to use the same IC's as presented here to arrive at the same results. Any IC's may be used that can fulfill the requirements of the block diagram. All IC's and display units to implement the block diagram are available from advertisers in this magazine.

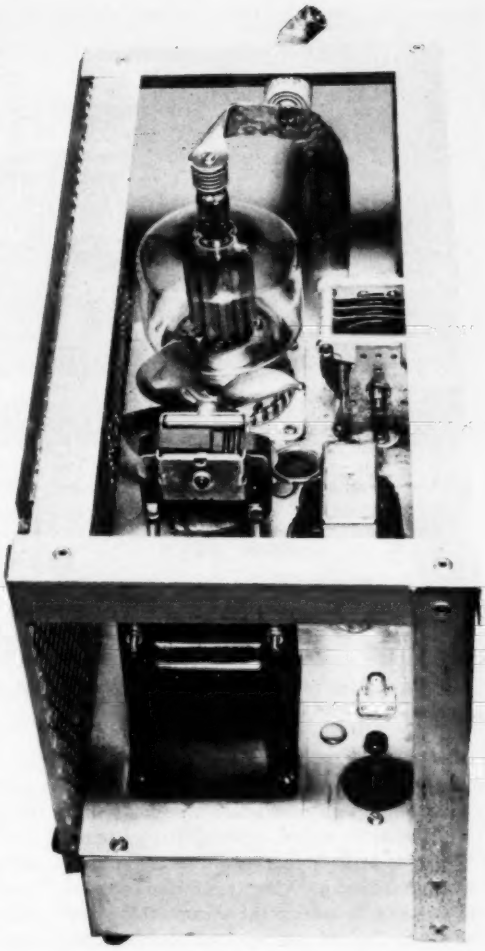
No specific information was given regarding the lighted display units, because each type has its own connection outline. It is only required that "a" thru "g" of the SN7447A go to the corresponding segments of your choosen display unit.

The photos show additional circuitry to that described here, that is because I incorporated the keyer. I also took advantage of the 2.4 second pulse and divided it down to make a 10 minute timer.

...VE1BU/W3

Ralph W. Campbell W4KAE
316 Mariemont Drive
Lexington KY 40505

KILOWATT LINEAR AMPLIFIER FOR 2 METERS



The 5-500A plate line is a Mylar wrapped "sandwich" of silver-plated brass sheet metal and bronze foil. By using dual plate line construction, inductance is halved and skin-effect reduced. The aluminum angle case structure is part if the rf output circuit! A stub and 90 high power quadrature coupler must be used to separate chassis ground from output "ground" on cables.

Wanting a full kilowatt linear amplifier for two meter moonbounce attempts prompted me to construct the unit described. It is a linear built around the Eimac 5-500A pentode, with special tuning and mechanical features to allow safe operation above 110 MHz. Both transverse and bottom seal cooling is employed; however, for IVS or double sideband, only natural seal cooling is necessary – with the exception of the plate seal which must always be blown.

I must admit I had difficulty keeping a good tube going within the linear because of high-duty factor operation, i.e., AM linear

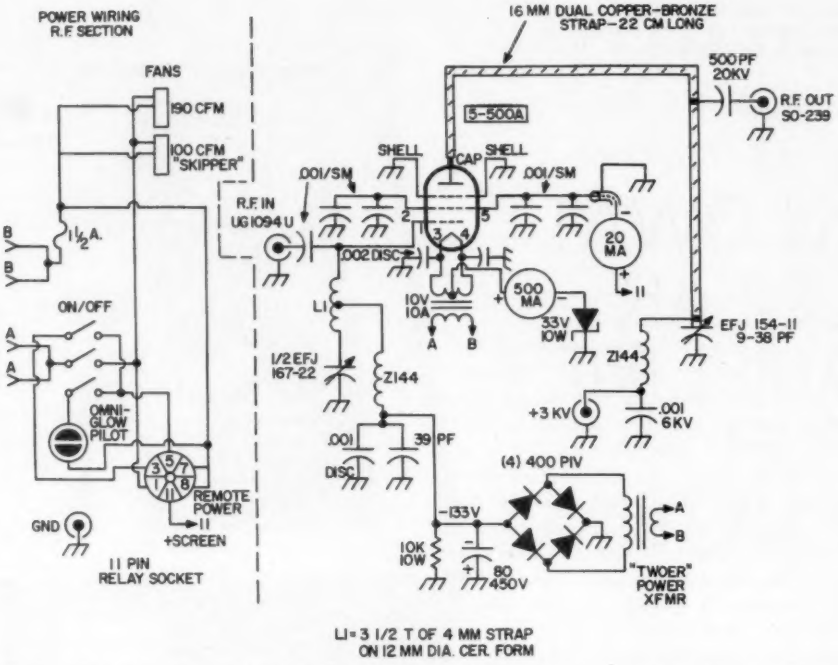


Fig.1. Schematic of the 1 kW 2 meter amplifier. Refer to the photographs for component placement.

and slow CW, and it was necessary to purchase an extra tube while experimenting. The first tube failed externally by arcing within the 5-500A base/shell, but there was no internal damage. After this I tried increasing the airspace around the socket (there was no room for an air system socket) and installation of a "whoosh-type" muffin fan blower on the bottom cover, directed at the socket. This last arrangement is the most satisfactory for AM linear operation.

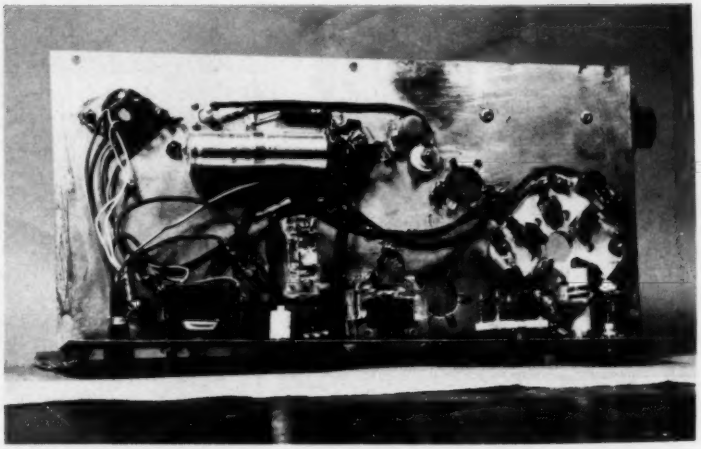
The basic electrical design is similar to conventional tetrode linears, with the exception that an extra grid – a suppressor – is employed in the tube design. This grid is attached to the outer mounting shell/rim of the tube base and is grounded by an Amperex UHF plate type connector. Input circuit design utilizes an "inductive" divider, which means it is a series tuned network in parallel with the input coaxial connector jack; however, the divider action is a result of tapping total series grid inductance similar to an rf autotransformer. In the theory section we shall describe this further.

Choice of a pentode for VHF linear service was the result of an original study I made into the shortcomings of beam tetrodes on VHF: There seemed to be so many reasons why a tetrode rig could be unstable, or need neutralization or suffer from secondary emission, that I gave up long ago on these tubes for ordinary 50 or 145 MHz operation. On 500 MHz or 432, the 4CX-series of tubes are excellent. A better VHF *ceramic* pentode is the 5CX1500, but I didn't have the money to experiment with this tube.

Although I was not successful in working moonbounce with the linear described, it was operated during an ARRL VHF QSO Party with excellent reports!

Theory

Graphs describing operation for a particular operating class are not provided here



Under chassis view of the Amplifier. Screen bypass capacitors must be silver mica, or rf will eat 'em up in seconds! It may be hard to find these rated to 1000V, but they are available as CM07 types. Inductive divider input circuit is used, with slug removed from form. Tube base and socket pins should be separately blown by muffin fan from bottom for high duty operation.

because it would make the text too long. However, those wishing to do an analysis are directed to do so with the Eimac tube performance counter, as supplied with their text: *"The Care and Feeding of Power Grid Tubes."* I have already done such an analysis on a pair of PL-177WA's. The class of operation here is AB_2, depending upon how hard the unit is driven and how much distortion is tolerable. A set of operating parameters is enclosed as a reference.

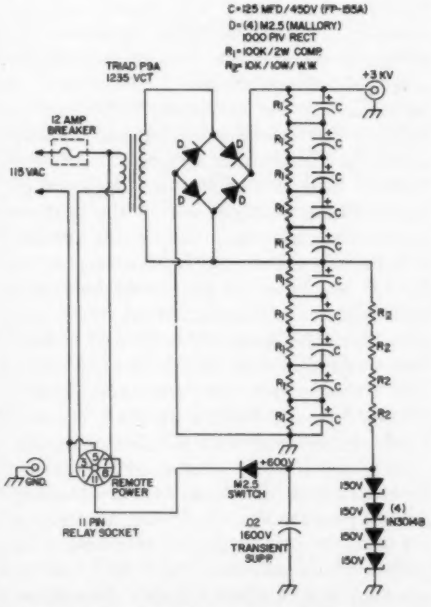


Fig. 2. Power supply for the 2 meter amplifier.

5-500A Specifications

Plate Volts	4000 (3000)
Plate Current	0.45 (0.33)
Plate Diss.	500
Screen Diss.	35 (16)
Drive Power	7 (5[estimated])
Filament	10V/10A
Screen	750 (600)

As can be easily seen, our 5-500A was operated well within its maximum ratings, noting that the maximum voltages and currents are at the left in each column and parentheses contain our figures. Bias, of course, is very important. We run about -133 fixed bias plus -33 zener bias off the centertap of the filament transformer, for about -165V or so total. There must be some grid current drawn, also, but it is very slight and impossible to measure bias attributed to it under key-down conditions. My TX-62 will drive the 5-500A to its highest power. Screen current is 10 mA or less, which is a conservative value. High circulating rf currents have been responsible for some of our troubles – high enough to melt the solder tabs even when the whole arrangement is transverse blown.

A limiting factor in VHF design is the high output capacity. On 2, it is necessary to series tune the plate tank, thereby providing an rf plate current maxima at the point where the strap comes closest to the sup-

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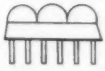

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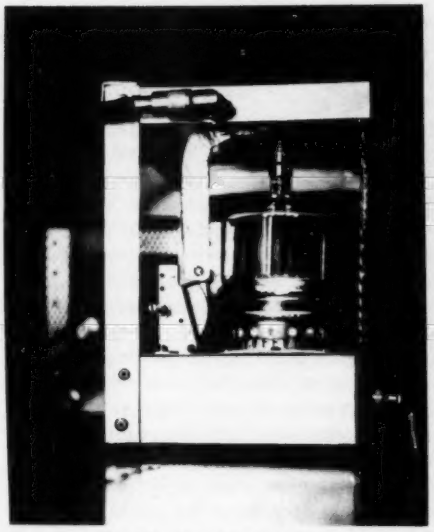
porting structure. This is the precise point where a blocking/coupling capacitor is installed. The strap consists of both the teflon sandwich and stator capacitor blades *and* the plate lead-length *inside* the tube as well. Another factor that can be limiting in the usual designs is the input capacity. Not here, however!

Power output of the 1 kW 2m linear is up to five times that of our reliable PL-177WA's, operated in parallel, We're getting 500W on our diode indicator, which was checked against a Bird Thru-Line Directional Wattmeter. The way this indicator (using a hot-carrier diode) was calibrated, under matched conditions, is this: With the 177's having a measured output of 100W rf, the diode indicator was placed in series and the meter reading noticed. Then, I wrote down 20 out of a full scale value of 50 units. With the bigger 5-500A linear and the exact same load in-circuit, the reading was 45 units most of the time and 50 units (and slightly off scale) when there was higher ac line voltage, as in the afternoon for instance.

Construction

The 1 kW 2m linear is built in a Bud Converta-Box chassis. Plexiglas is used for safety-of-life considerations, since metallic screening on only the front apron can be tolerated. Seems there's a cavity type rf mode within the enclosure, which can be quickly destroyed by placing any metallic screening on the other surfaces. The P-6461 Stancor filament transformer is mounted on the Converta-Box and not in the separate power supply. Also, there's the Barber-Coleman transverse cooling fan adjacent to it. An air system socket would have been used had Eimac thought to provide a suitable grounding strap on the SK-400. Separation was added later, to permit adequate air flow for cooling the base seals. The transformer next to the fan is a Heathkit "Twoer" power transformer used in the bias supply. The coaxial HV jack is rated to 5 kV and is featured for greater safety as well as a good ground between the supply and top deck of the box. A second ground is provided by means of a banana-jack plug next to the 11 pin relay socket which supplies low voltage, power and screen voltage to the unit.



Ambient light side view. Open case partitions are covered with Plexiglas, to prevent improper loading which would result with screening. Top channel cannot be "grounded" to lower chassis without loss of several hundred watts of output power. Amperex S-3706 suppressor ground connector is visible. Entire unit is built upon large Bud Converta-Box. Angle plug was replaced with Tee connector for addition of stub.

A Sprague 20DKT5 500 pF/20 kV ceramic coupling capcitor is mounted upon the sandwiched teflon plate line. At the point where the screw secures the "door-knob" to the line there is a juncture between the split-silver plated bronze (to the left) and the heavier soft brass dog-leg down to the EJF type 154-11 "E" capacitor. This variable has a range of 9 to 38 pF, which is just right to tune different variations in tube output capacities with the sandwich strap. The strap is a high efficiency ¼ wavelength tuned line, and not ½ wave. Even so there is a "cavity effect" within the enclosure.

The front apron controls are: Input, Grid, Quiescent Cathode Current, 30000V (neon lamp pilot), ON/OFF and Fuse. The input connector is an Amphenol UG-1094/U and the "grid" control is an EFJ butterly "L" capacitor, type 167-22. Only one half section is used. The cathode meter is an Emico Edgewise 500 mA plastic encased economy model. The ON/OFF switch is a Cutler-Hammer industrial 3-pole job with a high

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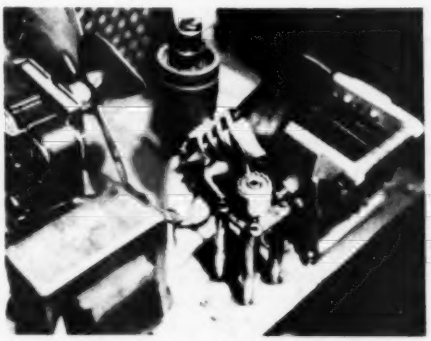
current rating. The fuse is a 2A Slo-Blo. The underside of the chassis shows routine components, a bridge rectifier plus filter and sockets.

The high voltage power supply is housed in a separate container. We chose a standard Par-Metal amplifier foundation measuring 6 x 14 x 3 (inches). Topside there's the Triad P-9A 1235V CT power transformer, some teflon "zener sink" stud cups, and an extensive bank of Mallory electrolytics. Each electrolytic is mounted separately with its own 100K/2W voltage equalizing resistor and ceramic posts which are bolted to the chassis proper. Oversize holes are drilled in the foundation to give high voltage lead clearance therethrough. The zener sink cups are actually portions of teflon C-cell battery tubing that have been cut off about 1 cm high, then they are filled with Wakefield type 142 thermal epoxy to make a good sink to chassis when the resin is cured. I tried the mica-insert-stud method of sinking the zeners, but when you series as many as four 150V units, the insulation is insufficient. The solution to the problem was to insulate the studs with fiber shoulder washers and encapsulate as shown. Only one P9A power transformer is shown for IVS service. Two are necessary for AM linear and prolonged CW uses.



Closeup of earlier coupling arrangement, discarded because of rf arcing through teflon insulation and shrinktubing. We had to change different output scheme to make it work properly. On 145 MHz a strap is a "tuned" circuit with 5-500A (high) output capacity. Only about 300W output with type loading. Current maximum must occur at output coupling point. Inductive coupling like this is no good.

An underchassis view of the power supply shows the Vectorboard silicon rectifier wiring and connections to the transformer leads and relay socket. A 12A circuit breaker is shown on the left. Sixteen Mallory M2.5 rectifiers are cascaded in rows of four each, for higher PIV. No equalizing resistors or capacitors are necessary on these devices since they are avalanche rectifiers, rated at 1 kV/2.5A each! There is another Emico meter shown, which used to measure the voltage drop across the 10K series droppers, but this was abandoned when the knee of the series-string resulted in the right screen voltage. A series M2.5 rectifier is used as a polarity sensitive switch, to prevent tube failures that result in destruction of the zener supply.A high voltage buffer capacitor is used across the screen regulator circuit to prevent transients from blowing these devices.

2KW power supply for the Linear. Four 10W stud mounted zeners are cooled by pools of cured Wakefield thermal epoxy, which is applied to the chassis. Electrolytics are mounted on 3/8th inch ceramic posts for high voltage insulation. Two Triad P9A plate transformers are necessary for CW or AM linear operation, although, the one shown here will do for SSB or DSB service.

Adjustment

This linear isn't really tricky to use. All that's necessary is to have some kind of indicator attached to the output connector (an swr bridge is fine here) and adjust the grid for a resonant peak and resulting increase in plate current. There should also be a resulting increase in signal output. If plate current rises too high, meaning an out-of-resonance tank, reduce the driver power to allow resonance to be reached without damage to the tube. By peaking the plate tank for highest output, which may or may not accompany a dip in line current, proper operation is achieved. A dummy load should be connected at all times.

The adjustments mentioned above should be repeated until maximum output readings are obtained. If a Heath Cantenna is used for a load, it should be operated for only a few minutes becuase of high rf output. A quick check should be made after these adjustments to ensure screen current and plate current meters are indicating safe values. Of course the best way to get an overall picture is to look at the 500W anode – if it is glowing a dully cheery red, you're probably all okay.

The external stub shown is a necessity for a perfect match on two meters, although there may be some installations that don't require it. This is made from a piece of open-circuited RG-8/U cable, exactly 21.60 cm long – from the back shoulder of a PL-259 plug – to the open end. The purpose of the stub is *not* to eliminate standing waves on the outside of the cable; rather it is for matching impedance of the inner conductor to resonant plate load impedance of the tube.

Conclusion

The 5-500A linear amplifer, or "1 kW 2m Linear," is a big help on 2. With up to 500W output from a mere grid drive of about 5W, is 20 dB gain that any transmitter can use – especially when the band is less active during low-bending VHF activity (the ionosphere does affect stratospheric bending). I have had no more problems with Hi-Fi interference than with the TX-62 that drives it, so once you alleviate problems caused by the TX-62 you should have no further difficulty operating this equipment!

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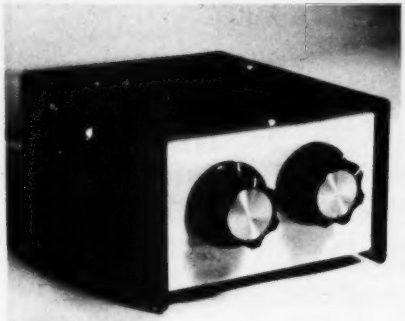

A SIMPLE IC KEYER

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The gating action of the clock must operate in the following sequence. The clock is enabled by either the paddle or the output which is the method of self completing. When the output goes low after the completion of a dot or dash and the paddle is not depressed the clock is disabled, and must remain disabled for at least one dot time duration, after which it should be able to start on demand. This provides a minimum spacing between dots and dashes regardless of the motion of the paddle.

The oscillator uses a SN7413 Schmitt trigger as a relaxation oscillator. Typical waveforms appear in Fig. 2.

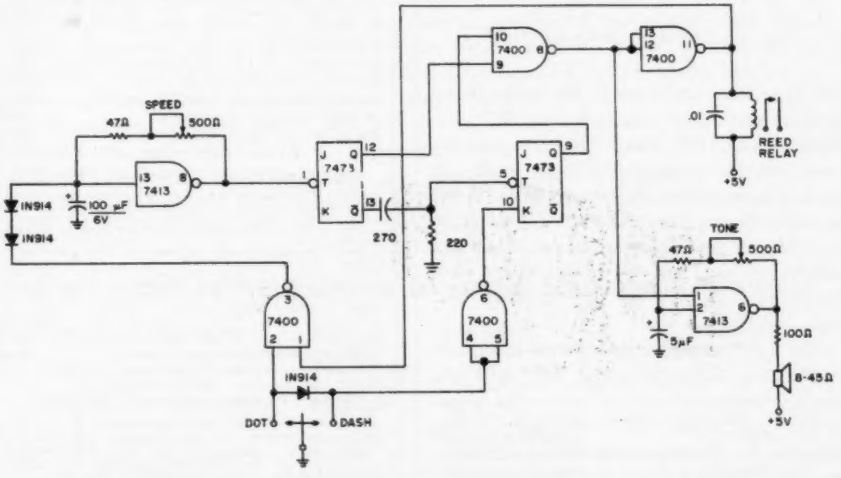

Fig. 1. Schematic diagram of the keyer.

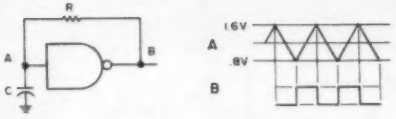

Fig. 2. Relaxation oscillator and associated waveforms.

These criteria require a control signal to disable the clock, prevent any negative transition for one dot duration and then be ready on demand. The circuit in Fig. 3 accomplishes this function with the minimum components.

When the control line is low the circuit oscillates normally. When the control line goes high, which in the keyer coincides with the negative transition of the clock, the diodes conduct and the capacitor voltage quickly discharges from 1.6 to about 1.5V, which is the sum of the "0" output voltage of the gate and the two .7V diode drops.

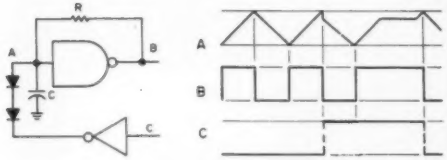

Fig. 3. Control circuit for the clock.

The capacitor continues to discharge at the usual rate until it reaches the SN7413's threshold of .8V, when the gate changes state and the capacitor voltage heads up again. The capacitor charges up to 1.5V and becomes clamped by the diodes. The oscillator is now ready for operation. When the control line goes low the capacitor can now charge up 100 mV to the threshold and begin oscillation.

The oscillation is not "instant" start, but "fast" start. Approximately 10% of a dot duration is required for start-up.

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PRECISION WAVEFORM GENERATOR

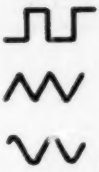
This article describes a compact signal generator that simultaneously outputs square, triangular, plus, unlike others, sine waves in the frequency range of 0.05 Hz to 1 MHz. Although the author's unit is a signal generator, it can be used as a frequency modulator or voltage controlled oscillator with only minor circuit modifications.

The signal generator utilizes the advanced Intersil 8038 monolithic chip which features:

- simultaneous sine, square and triangular wave outputs
- low distortion (1%)
- high linearity (0.1%)
- wide frequency variation (.001 Hz to 1 MHz)
- variable duty cycle (2% to 98%)

Typical amateur applications for this waveform generator are:

- RTTY AFSK Keyer
- FM modulator
- voltage controlled oscillator
- signal generator



All this from a single IC!

Signal Generator Circuit

The heart of the signal generator is the Intersill 8038 waveform generator. The schematic diagram of Fig. 1, shows the author's circuit of a signal generator. This circuit consists of the waveform generator, timing capacitors and potentiomenters, and a dc coupled buffer amplifier. This amplifier is switched to the desired wave shape output. Three dedicated buffer amplifiers and output terminals may be used for additional flexibility.

Components

The timing capacitors C1 to C8 should be high Q, low tolerance components where possible. These capacitors determine the frequency decades of the signal generator. R1 serves for frequency tuning within each range, R2 determines the frequency coverage of R1, R3 and R4 limit the upper frequency of the ranges. A good quality linear taper potentiomenter with at least 270° taper function should be used for R1. Using a linear potentiometer for R1 the dial scale will be semi-logarithmic.

With the resistor and capacitor values as listed, the following frequency ranges are covered (R1, R2, R3 and R4 are adjusted to give a 600 to 6000 Ohm tuning range):

Capacitor	Frequency Coverage
C1, 500 μF	.05 Hz – .5 Hz
C2, 50 μF	.5 Hz – 5 Hz
C3, 55 μF	5 Hz – 50 Hz
C4, .5 μF	50 Hz – 500 Hz
C5, .05 μF	500 Hz – 5 kHz
C6, .005 μF	5 kHz – 50 kHz
C7, 500 pF	50 kHz – 500 kHz
C8, 250 pF	100 kHz – 1 MHz

If different values of capacitors or resistors are more convenient, the resulting frequency for different RC values may be calculated from the following formula:

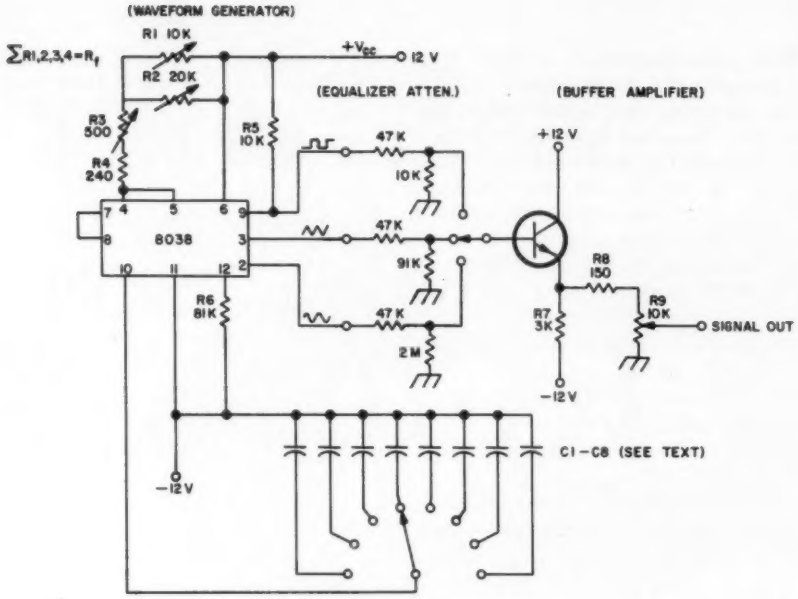


Fig. 1. Schematic of the triple-wave output signal generator.

$$F = \frac{150{,}000}{R \times C}$$

C is the timing capacitor in μF and R is the total resistance between +VCC and terminals 4 + 5 in Ohms.

The permissable resistance values between terminals 4, 5 and +VCC range from 250Ω to 500kΩ. The permissable supply voltage may vary from ±5V to ±15V and preferably should be regulated. A single supply of +10 to +30V may be used, but it is then advisable to decouple the output with a capacitor because of the large dc offset voltage. This will likely cut down on square wave and low frequency response.

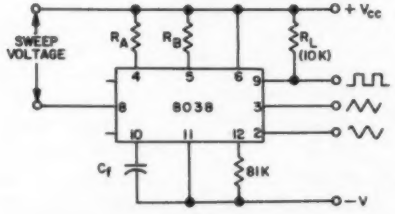


Fig. 2. Sweep circuit and voltage controlled oscillator.

The sine, square and triangular wave outputs at chip pins 2, 9 and 3 have different output levels. These levels are, (with a 100kΩ load resistor), 0.9 x Vs for the square wave, 0.3 x Vs for the triangular wave and 0.2 x Vs for the sine wave signal. (Vs = total supply voltage). Thus, with 24V supply voltage, the available output levels are 21V peak to peak (square wave), 7.5V peak to peak (triangular wave) and 5V peak to peak (sine wave). The square wave and triangular wave outputs are therefore attenuated to the same level as the sine wave output before going into the buffer amplifier.

Buffer Amplifier

A simple buffer amplifier is shown in Fig. 1. The resistor dividers provide equal signal levels to T1 and reduce the loading effect of the low base input impedance. T1 is a 2N3709 high gain amplifier transistor which is wired as an emitter follower to provide a lower output impedance than the 8038 chip. The signal level for all waveshapes at ±12V supply voltage is approximately 5V peak to peak.

CIRCUIT ALTERNATIVES

AFSK Generator

Because of it's high stability and low distortion the sine wave output is perfect for RTTY audio shift frequency keying. Two methods of frequency shifting are possible with this unit. The value of the frequency determining resistor may be switched, or a frequency shift voltage may be introduced to terminal 8 as indicated in Fig. 2. If the first of the two methods is used, typical values of Cf and Rf are (with Cf = .033 μF):

R_f = 3135 Ω
f = 1450 Hz mark frequency
R_f = 2806 Ω
f = 1620 Hz (170 Hz shift)
R_f = 1976 Ω
f = 2300 Hz (850 Hz shift)

Frequency Modulator

Fig. 3, shows a typical schematic for narrow band frequency modulation. The frequency of the waveform generator is a direct function of the dc voltage at terminal 8, measured from +VCC. By altering this voltage, frequency modulation is performed.

For small deviations of (e.g. 10%) the modulating signal can be supplied to pin 8 through a decoupling capacitor. An external resistor between pin 7 and 8 is not necessary but can be used to increase the input impedance, which then increases from 8kΩ to 8kΩ + R.

For larger FM deviations or frequency sweeping, the modulating voltage is applied between the positive supply voltage and pin 8. A 1000:1 sweep range can be achieved with a change of f = 0 at V sweep = OV. The potential at pin 8 may not exceed 2/3 of +VCC.

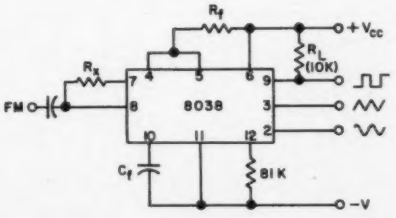


Fig. 3. Connections for frequency modulation.

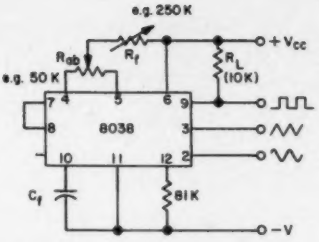


Fig. 4. Variable duty cycle oscillator.

A typical ham application would be to produce a frequency modulated (e.g., 455 kHz i-f) signal for mixing purposes. Another use for this circuit is the determination of filter bandpass curves by frequency wobbling.

Variable Duty Cycle Oscillator

If the timing resistor circuit (R1 through R4, Fig. 1) is changed as outlined in Fig. 4, the duty cycle of the output signals can be adjusted from 2% to 98%. Thus, a variable mark-space ratio square wave or a sawtooth shaped triangular wave can be generated. The frequency of a (360°) wave stays constant regardless of the position of R_{AB}. Rf permits about one decade of frequency adjustment without changing Cf.

Comments

After you build this signal generator the dial has to be calibrated. This work requires preferably a frequency counter. The high value timing capacitors (50 μF and 500 μF) were electrolytics, and my dial calibration was somewhat "out" on these 2 low frequency ranges. The wave outputs of the 8038 deteriorated slightly above 500 kHz.

The cost of the signal generator runs about $20. The Intersil 8038 function generator chip can be purchased for $5 in the U.S., $6.90 in Canada, in single quantities. What makes this unit so handy is that it – unlike the NE566 generator – outputs a sine wave signal also. It is a worthwhile piece of equipment for the homebrewer.

...VE3GSP

References: Intersil application note; 8038 waveform generator.

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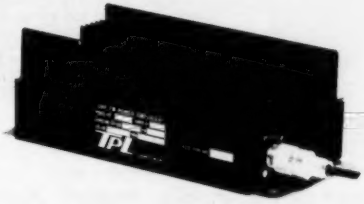

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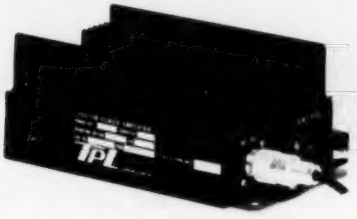

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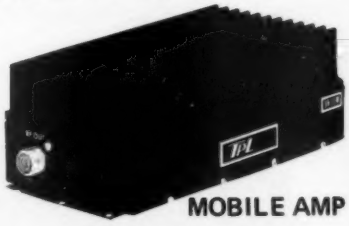

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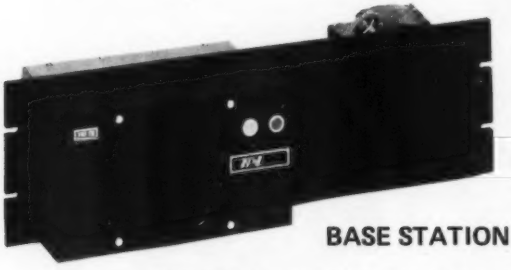

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PA3-1DD	5-15W	60-80W	136-175MHz
PA3-1EE	50-250mw	80-120W	"
PA3-1AE	.75-3W	80-120W	"
PA3-1DE	5-15W	80-120W	"
PA6-1DE	1-4W	20-30W	400-512MHz
PA6-1AD	4-10W	25-35W	"

FCC type accepted for operation under parts 21, 81, 89, 91, 93, 95. Meets FCC specification: Part 5, subpart C, paragraph 5 103 (a).

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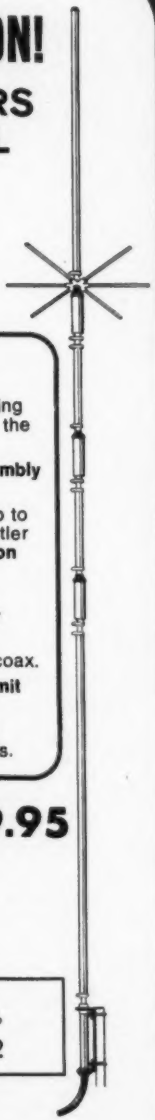

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The helical resonator consists of a coil containing roughly one quarter wavelength of wire enclosed in a shield and grounded to the shield at one end. Dimensions are calculated from L and C equations based upon the shape factor of the coil and size relative to the shield. This shape factor, once established, must be closely adhered to if degradation of Q is to be avoided. Those interested in derivation of the design equations should refer to the references cited.

Nomographs are often utilized for roughing out a design, formulas to fix the design, and trial and error for final adjustment. Figures 1 and 2 are unique in being the nonmovable portion of a slide rule. The sliding portion is constructed as follows: Set a sheet of paper with one edge at 1 on the frequency scale. Mark the frequency of interst and cut perpendicular to the scale. In the center near the word SQUARE or CIRCLE cut half way parallel to the frequency scale and fold. The slide will be similar to the dotted area of Fig. 1, which is constructed for 21 MHz. The lower edge should be set to the desired cross-section size, 4 centimeters in the example. Sizes D

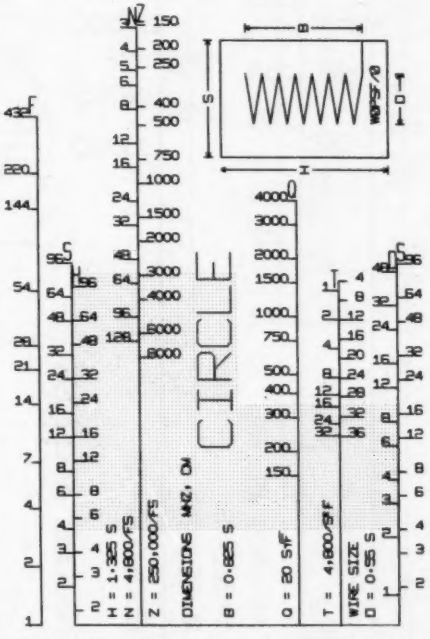

Fig. 1a. A reduced version of the nomograph on the next page showing the shape of the movable paper mask (shaded portion) used for determining helical resonator dimensions. A new mask must be made for each frequency band. The one shown is for 21 MHz.

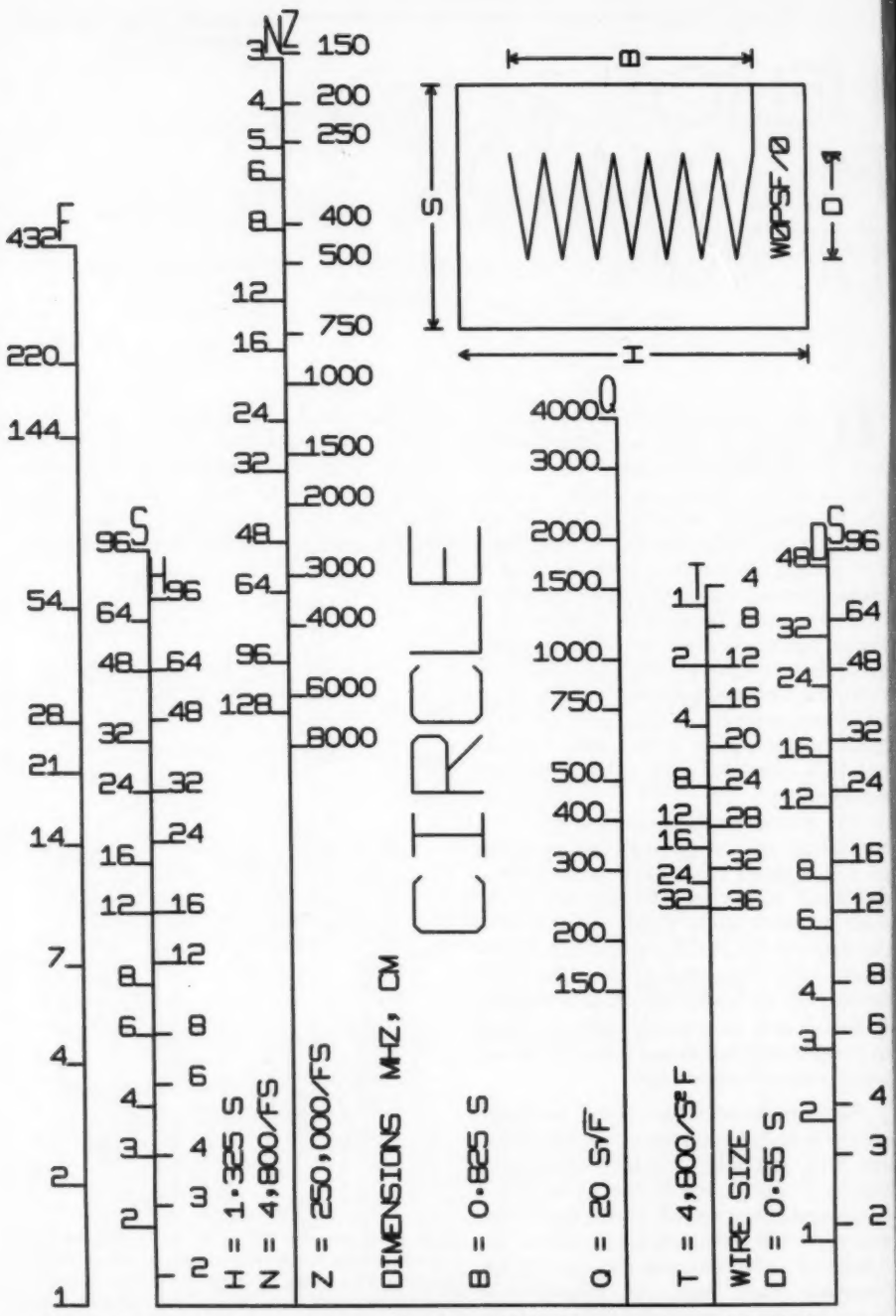

Fig. 1b. Nomograph for determining the dimensions of helical resonators in round shields. See text and Fig. 1a, for use.

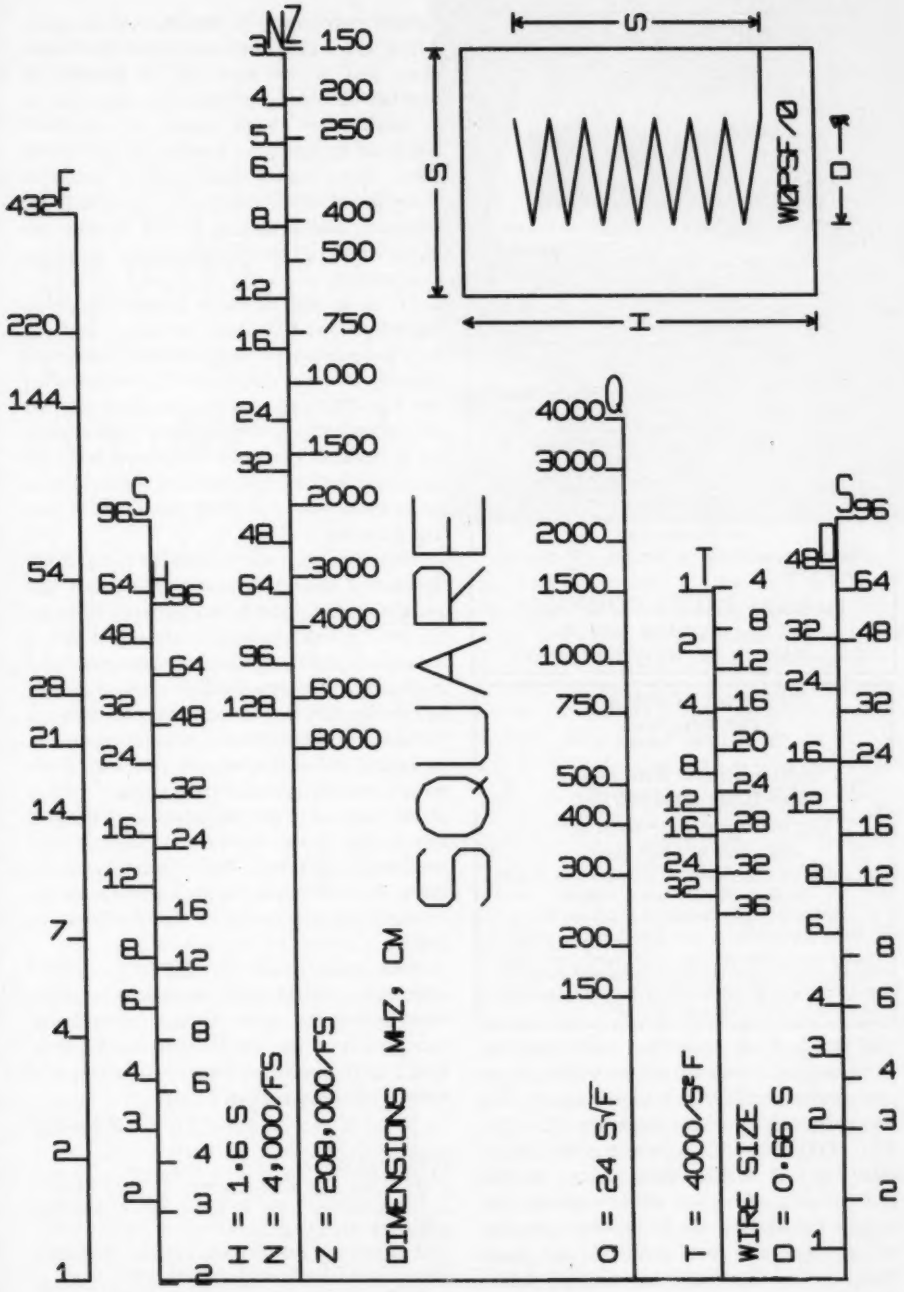

Fig. 2. Nomograph for determining the dimensions of helical resonators in square shields. See text and Fig. 1a, for use.

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and H are read from the lower edge. Q, impedance (Z), number of turns (N), turns per centimeter (T), and wire size are read from the top. For the example: 2.2, 5.3, 370, 3000, 14.3, 30. Wire size is that which fills half of the winding space. In this manner, the effect of shield size on the desired parameters may be quickly explored. No attempt has been made to add many divisions to the scales as working values should be calculated from the formulas listed near each line. Values will be within ten percent. Practical size limits are those smaller than results in less than three turns, where the helix loses its shape and larger than that where wire size is limited by number of turns and resistance degrades Q.

Ideally the shield should be seamless. Unplated copper pipe is excellent up to 100 MHz, but wastes space unless amplifier components are fitted in. Square shields are compact, and soldering or dip brazing the seams shouldn't prove difficult for the home constructor.

If, as in the formulas given, the shield extends beyond the coil, no top or bottom caps are needed unless maximum shielding is desired. If used, they must be soldered for low loss. The coil may be directly grounded or attached to a low loss feedthrough capacitor if needed. The open end should not turn in or out and the end rounded if power is to be applied. Any coil form should be of low loss material.

Coupling is best determined by trial. Simplest is the familiar tap, very close to the grounded end, which also adds stability to the coil. A link around the grounded end or a probe at the open end have been used. An aperture at the base is often used to couple square shields, but is difficult to adjust. A variable capacitor in series with the normally grounded end allows variable coupling: minimum coupling being when the capacitance is series resonant with the portion of the coil below the tap and maximum coupling at maximum capacity. Fine tuning may be made by deforming the coil slightly or by adding a small trimmer or disc to the open end.

With their inherent simplicity, helical resonators should find numerous applications as repeater front ends, as narrowband receiver filters for the DX bands, and even W1BB might find the 1 KHz bandwidth of a large oil drum useful on 160m.

...WØPSF/Ø

REFERENCES:

1. Macalpine and Schildknecht, "Coaxial Resonators with Helical Inner Conductors," Proceedings of the IRE. December 1959.
2. Macalpine and Schildknecht, "Helical Resonator Design Chart," Electronics. August 1960.
3. Myers and Greene, "Field Day Filters," QST. April 1973.
4. Zverev, A: *Handbook of Filter Synthesis* Wiley, New York, 1967.

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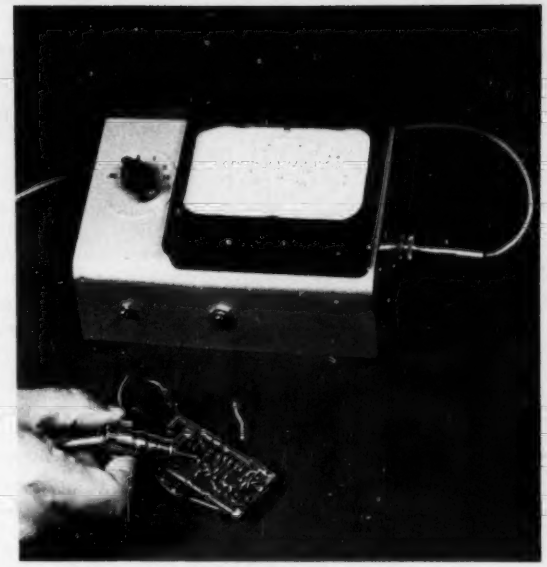
SENSITIVE RF VOLTMETER



This rf voltmeter has full-scale ranges from 0.03V to 10V and frequency response flat from 40 kHz to over 200 MHz, making it useful for most solid-state work. It is portable and battery operated. I had need of such a meter in my work. After hauling a commercial meter and a 115V ac generator out in the boondocks a few times, I decided to try and build a battery-operated meter.

The performance and accuracy of the finished meter depends greatly on how much care is taken with the matching of the semiconductors in it, and the adjustment and calibration. These procedures will therefore be described in considerable detail.

The circuit uses a rectifier-type probe, followed by a high-gain dc amplifier driving a milliammeter. The first try at a dc amplifier used a pair of FET's connected as a differential amplifier to drive a microammeter. To get the required sensitivity, it was necessary to select high-transconductance, high-current FET's and to use a meter of 0–50 μA or even less range. It was found that this circuit required 18–20V supply to keep the FET's operating linearly, and it could dump several milliamperes into the meter if it became unbalanced for any reason. When I found I had no spare sensitive meter, and none of my friends was about to turn any loose, this whole approach was dropped.

A two-stage amplifier was then tried. This time the FET's were chosen for low pinch-off voltage, therefore low current drain. This meant the voltage drop in the biasing resistor and the drop from drain to source could also be low. The stage would work with supply voltage from a 9V battery, even a fairly old battery which had fallen off to 7V or so. The gain of the stage was low, too, but the following high-gain pair of transistors in the second stage took care of that. The complete circuit in Fig. 1 would easily drive a rugged 1-mA meter. At the same time, it would not deliver enough overload current to hurt the meter. The total battery drain was about 5 mA from a 9V battery.

The rf probe is a voltage doubler circuit, using silicon diodes which are forward-biased for maximum sensitivity. Germanium diodes were tried first, but the silicon diodes proved to be much less affected by temperature. With proper forward bias, there is very little difference in small-signal performance between germanium and silicon types. A second pair of diodes with no rf input signal are mounted in the probe and connected to the other side of the dc amplifier's balanced input circuit, thus compensating for any temperature drift in the rectifier diodes. The capacitors C1 and C2 in the probe are deliberately kept small to restrict the low frequency response of the meter for several

reasons: to make the meter insensitive to hum pickup, to make it read carrier level on an audio-modulated signal regardless of the modulation percentage, and to minimize the strain on the diodes if the probe is accidentally touched to a point of high dc potential.

Referring to Fig. 1., diodes CR1, CR2 and capacitors C1, C2 are the voltage doubler. The compensating diodes CR3, CR4 are mounted in the probe also, so they will stay at the same temperature as CR1 and CR2. The diodes are type 1N914, which have excellent high frequency performance, reasonably high voltage rating and low cost. These parts are mounted in an old lipstick case. The business end of the probe is a piece of No. 14 tinned bus wire, straightened out and filed to a point. The removable 50Ω 2W load is built into the lipstick cap as shown in Fig. 2. At the 10V maximum input to the instrument, this load just reaches full dissipation. The reverse voltage rating of the diodes is high enough so there is a comfortable margin of safety at 10V rf input. The probe connects through two-conductor shielded microphone cable to a two pin microphone plug mating with the two pin connector on the cabinet. Any small three-wire or two-wire-plus-ground connector would do.

The Amplified Circuit

The dc signal and reference outputs from the probe are each connected to a voltage divider associated with the range switch S1. The cold ends of the two voltage-divider strings are connected to the bias source, diodes CR5 and CR6, which are supplied about 0.4 mA current through resistor R11. (This is far more current than will ever flow in the voltage dividers, so there is always current flowing through CR5 and CR6.) The negative voltage across CR5 and CR6 forward biases the signal diodes CR1 and CR2 for best sensitivity. Even with no rf input to the probe, a tiny forward current flows from the bias source through resistors R1, 2, 3, 4, 5 and the signal diodes. An equal current flows through R6, 7, 8, 9, 10 and the reference diodes CR3, CR4, so that if the diodes and resistors have been well matched (as described later), equal voltages will appear at the output contacts of switch sections S1a and S1b when no rf signal is applied to the probe, and the meter will read zero. As rf signal is applied, the dc voltage at

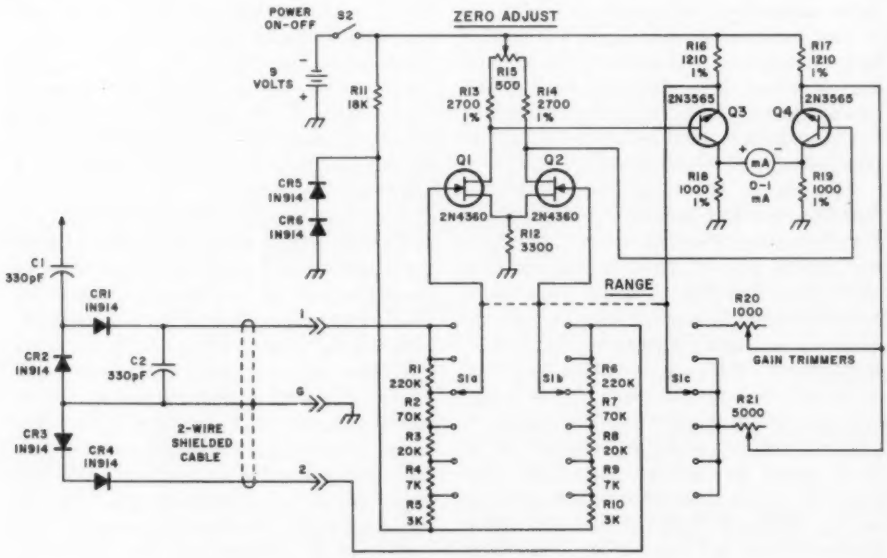
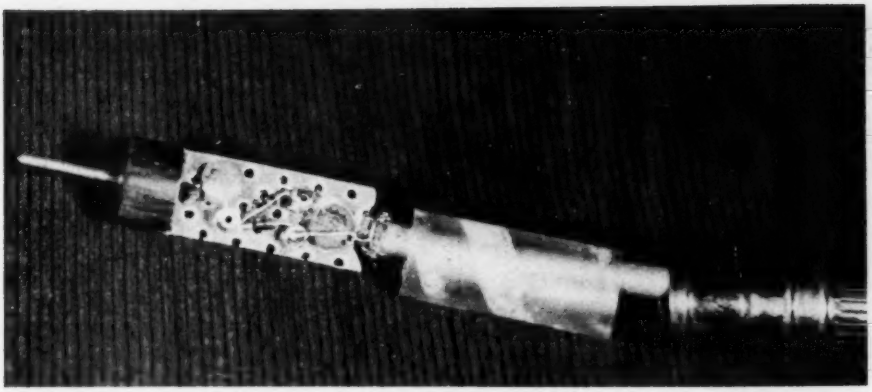


Fig. 1. Circuit diagram of the WA6NIL rf voltmeter.



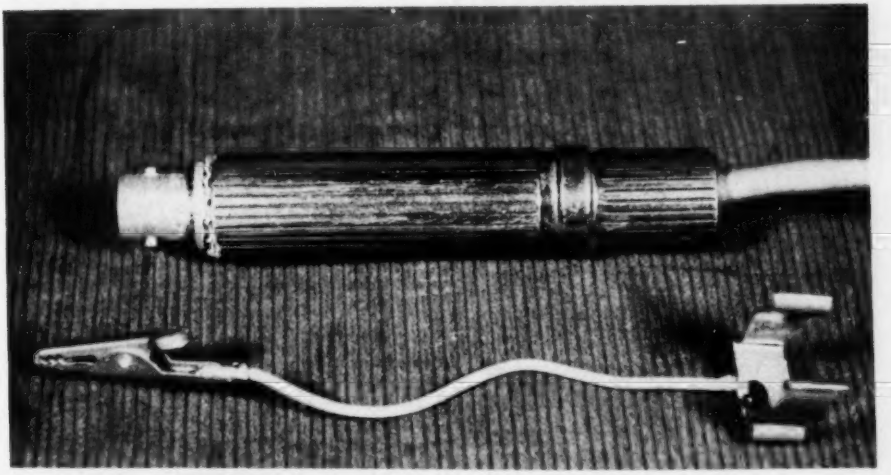
The rf probe is built on a small piece of perf-board and then tucked into your favorite-brand lipstick case.

S1a (feeding the gate of FET amplifier Q1) becomes more positive, while the voltage at S1b feeding the gate of Q2 stays put.

Field-effect transistors Q1 and Q2 are matched and the Zero Adjust control R15 is set so that the drain voltages of Q1 and Q2 are equal when their gate voltages are equal, that is, when no rf input voltage is applied to the probe. The large common-source resistor R12 causes the total drain current of Q1 and Q2 to stay about constant, so that while Q1 drain voltage goes negative as rf signal is applied, Q2 drain voltage goes positive by a nearly equal amount.

The second-stage amplifiers Q3 and Q4 are high-gain NPN transistors, selected for highest gain and matched so that the meter between their collectors reads zero or very near it when the voltages at their bases (from Q1 and Q2 drains) are equal. A slight adjustment of the Zero Adjust control will then make the meter read exactly zero at no signal input.

The large resistors R16, R17 in the emitter circuits of Q3 and Q4 would, without the gain trimmer resistors, make this stage very low gain and stable because of the large inverse feedback. One of the gain



The top of the case contains a 50Ω load and plugs onto the rf probe. The construction is detailed in Fig. 2. Ground connection is accomplished via the short piece of wire and clip.

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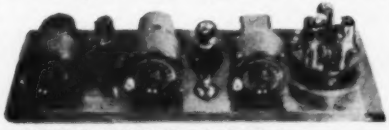

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trimmer variable resistors, R20 or R21, as selected by the range switch S1c, is connected between the two emitters; when this resistance is small, the inverse feedback is cut down and the stage gain is high, while when the gain trimmer resistance is high, the stage gain drops to a low value. It was originally intended that this method of changing gain would be used for switching between the three most sensitive ranges, leaving the other ranges to be switched by the voltage divider R1-R5. However, the efficiency of the diodes in the probe is very low on the 0.03V range, so there is a large difference in gain between this and the 0.1V range in the dc amplifier. The Q3-Q4 stage must run at nearly full gain on the 0.03V

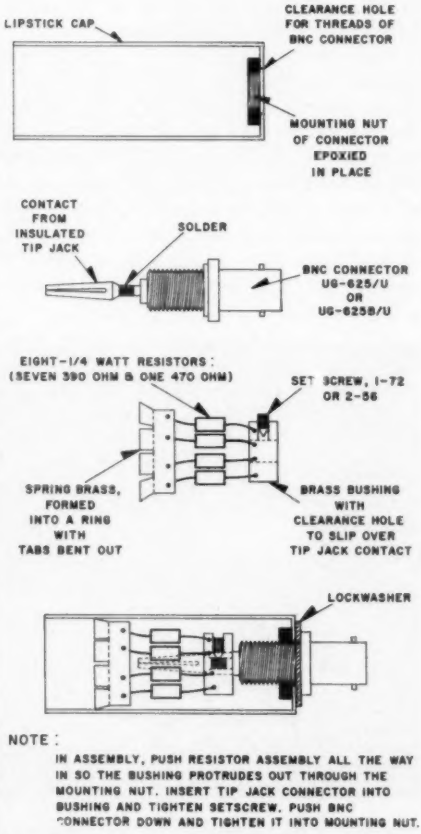
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Fig. 2. Construction of the 50Ω probe adaptor.

range, and almost at minimum gain on the 0.1V range. The voltage divider then provides switching to all the higher ranges. A third gain-trimming resistor was originally provided and can be seen in the photo, but will not be needed if the voltage divider resistors are adjusted as described later.

The 1 mA meter is a surplus item. It is a large rectangular type; a large size is desirable since four scales must be put on it. The meter originally had an odd-ball scale, furlongs per fortnight or something, but this did not matter as new scales had to be drawn and hand-calibrated anyway. The original scale was used to determine the proper size and location of the new scales. The dial plate was then turned over and the new scale glued on its back with rubber cement. The meter is connected between Q3 and Q4 collector to read the current unbalance between them.

Construction

The layout and wiring of the instrument is not critical. All the high-frequency circuitry is in the probe, and the rest can be laid out in any convenient fashion. The only front panel controls are the range switch, the battery on-off switch and the zero-adjust potentiometer. I used a screwdriver-adjusted control for the zero adjust, as it was all I had, but a knob would be better. I built my meter in a sloping-front cabinet which happened to be in the junk box, with the dc amplifier and voltage dividers on a piece of perforated board with push-in terminals. This construction is like a breadboard in that it is easy to make circuit changes, yet it is compact, rugged and stable enough for a permanent job.

Looking back on it, mounting the voltage dividers R1-R5 and R6-R10 on the range switch would have made the job a lot simpler, since not so many wires would have run between the switch and the circuit board. The FET's and transistors were mounted in sockets rather than soldered in, to make matching easier.

The first thing to do is to lay out the parts in the cabinet or chassis and panel, and mount the meter, zero adjust control, on-off switch, battery holder and the connector for the rf probe. The range switch with its

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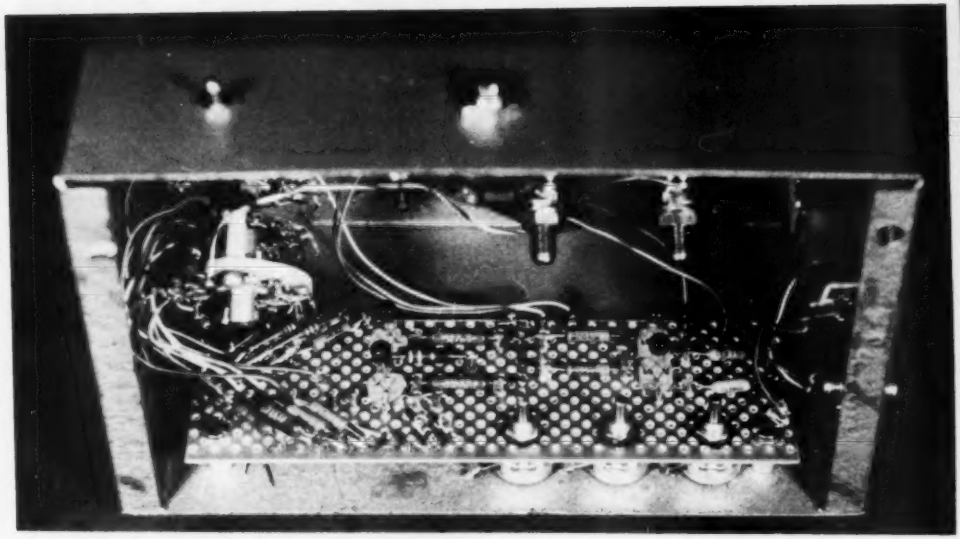

Underchassis view of the voltmeter showing component mounting. The gain trimming pots are mounted along the bottom edge.

associated resistors should be mounted temporarily where it will be accessible, as the values of the resistors will have to be adjusted later. Then the circuit board is laid out and built up with the sockets for Q1, 2, 3, 4 and the rest of the parts. Most of the semiconductors in the circuit must be selected and matched, but the bias source diodes CR5 and CR6 are not critical and may be mounted at this time. When installing diodes, it is good insurance to make a small loop in the lead wires between the body of the diode and the solder terminal, to relieve the strain. If you can, use close-tolerance resistors where they are called for. Buying 1 percent resistors in small quantities is an expensive sport unless you can find them in surplus. Matching of pairs of resistors in the two sides of the circuit, such as R13 with R14, or R16 with R17, is more important than their actual value. In the case of the voltage divider resistors, their values will be trimmed later anyway, so the main reason for using precision resistors here is their stability. If you are forced to use ordinary composition resistors, pick matched pairs with a good ohmmeter and use the same precautions you would when soldering in transistors or diodes – leave a little length of lead between the body of the resistor and the solder joint, and put an alligator clip or other heat sink on the lead while soldering.

When this much of the circuit is built up and checked out visually and with the ohmmeter, you are ready to select the FET's and transistors.

Selection of Semiconductors

This circuit does not use any of the fancier techniques such as chopper stabilization to hold down unbalance and drift. It is therefore very necessary to select and match the semiconductors for best results, especially since the inexpensive devices used in this circuit have a much wider spread in characteristics than do vacuum tubes. It is true that carefully matched pairs of FET's can be had, but these could easily cost more than the whole instrument. It seems much better for amateur purposes to buy a good quantity of each type and select out pairs, leaving the rest available for other uses. It is a great help

if you have access to a stock of them. In any case, you should have available at least half a dozen each of the 2N4360's and 2N3565's and a dozen 1N914's or 1N914A's. It won't hurt to have more, as they are all very useful devices.

The first step is to select the FET pair, Q1 and Q2. Set up the test circuit of Fig. 3, remembering that the FET pin connections are different from transistors. Plug in the 2N4360's one after the other and select all those which draw between 0.4 and 0.5 mA. Pick the two which draw most nearly the same current and put them in Q1 and Q2 sockets.

Now to match up the second stage transistors. Switch to the 0.03V range and turn gain trimmer R20 to zero resistance. Connect the circuit to the 9V battery. Temporarily connect the base pins of Q3 and Q4 sockets to each other with a clip lead or jumper. Now try various pairs of 2N3565's in the sockets, looking for pairs that make the meter read nearest zero. If you have a transsistor dc beta (h_{FE}) tester available, pick the pair that show the highest beta. If not, remove the temporary jumper from Q3-Q4 sockets. Plug each selected pair of 2N3565's in turn into Q3 and Q4 sockets, and choose the pair which produce the greatest meter deflection for a given small amount of the zero adjust control. Leave the chosen pair in Q3 and Q4 sockets.

This much of the circuit is a nice sensitive dc voltmeter of about 10 mV dc full scale deflection at maximum gain. It is now ready to be used for matching up the diodes. Set the range switch to its 0.1V range and adjust the gain trimmer R21 to maximum resistance. Connect one diode between input pin 1 of the probe connector and ground as shown in Fig. 4; be sure to connect it the right way round. Temporarily jumper input pin 1 to pin 2 and turn the zero adjust control to put the meter needle on some

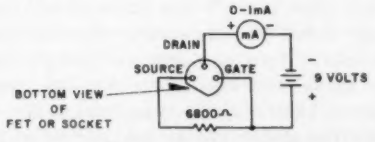

Fig. 3. Test circuit for selecting matched FET's.

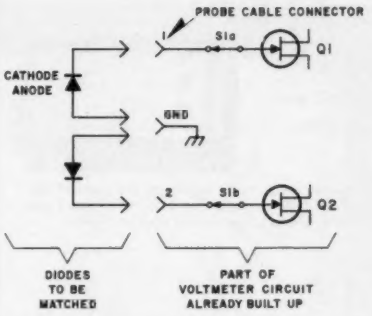

Fig. 4. Method of matching 1N914 diodes.

mark near the center of the scale. Now remove the jumper between the input terminals. Try the other 1N914 diodes between input pin 2 and ground, sorting them into groups by the meter deflection they cause.

Switch to the 0.03V range, set R20 to zero resistance, and again jumper the input pins together. Turn the zero adjust control to put the meter needle on the mark. Remove the jumper, and try pairs of diodes from the various groups for match by connecting one diode from pin 1 to ground and the other from pin 2 to ground. The idea is to pick pairs of diodes which bring the meter needle closest to the mark, thus having exactly the same voltage drop as closely as possible.

Use one of the best-matched pairs of diodes for CR1 and CR3, and another well-matched pair for CR2 and CR4. It is not necessary that CR1 and CR2 be alike, or CR3 and CR4, though it will do no harm. These diodes may now be installed in the rf probe, observing the usual soldering precautions, and the probe assembly finished up.

The meter is now ready to be calibrated.

Range Adjustment and Calibration

Calibration of the voltmeter requires a radio-frequency signal of known and adjustable level. If you can borrow a good signal generator with 2 or 3V rms maximum output, it will do nicely. An uncalibrated signal source can also be used if you have some way of measuring its output, such as a calibrated oscilloscope or another rf voltmeter. If a signal generator is used, be sure to consult its instruction manual to find out

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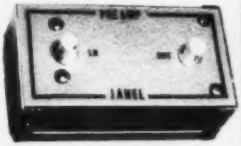

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whether it delivers its rated voltage output into a matched load or an open circuit. Most generators built in the U.S. deliver rated voltage into a 50Ω load. Assuming you have such a generator, attach the 50Ω load to the rf probe and connect it to the signal generator output.

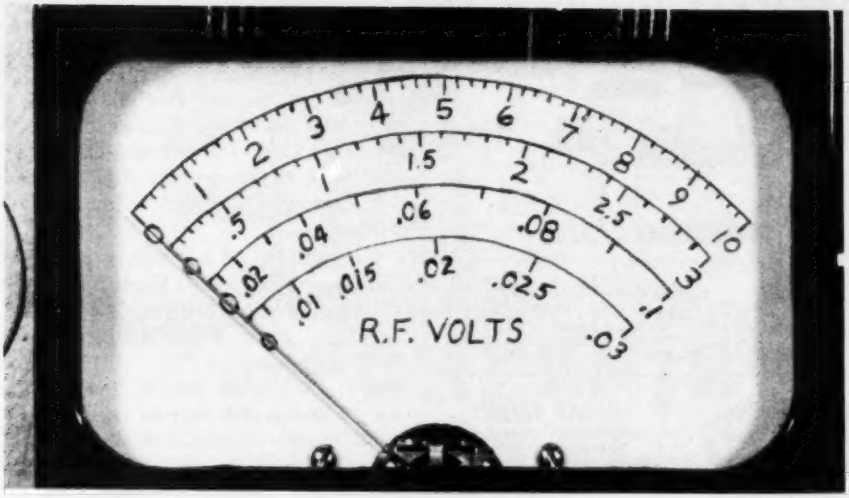
Switch the range switch to 0.03V. With no signal input, turn the zero adjust control to zero the meter. Put in the 0.03V rms signal at a frequency of a few megahertz and adjust gain trimmer R20 for full scale meter deflection. (If full scale deflection cannot be obtained, you will have to pick a higher gain pair of FET's Q1 and Q2, or higher gain transistors Q3 and Q4.) Now switch to the 0.1V range and, with no signal input, again zero the meter. Put 0.1V rms into the probe and adjust trimmer R21 for full scale deflection. On each range, recheck the zero after adjusting the gain trimmer; readjust both the zero and the gain as necessary.

Switch to 0.3V range and re-zero the meter with no input signal. Put in 0.3V rms and note the meter reading. If it is over full scale, R2 is too high. Connect a variable resistor of several megohms maximum resistance across R2 and adjust it for full scale deflection. Remove the variable resistor, check its resistance with an ohmmeter and connect a fixed resistor of this value across R2 with the usual soldering precautions. (If the meter reading was below full scale, R1 is too high and must be shunted down in the same way, but this is not likely.)

Now switch to 1V range, re-zero the meter, and put 1V rms in. The meter will probably read over full scale again, indicating that R3 is too high. Shunt it down in the same way. If the change in R3 is more than 5% or so, go back and check the 0.3V range again.

Switch to the 3V range, re-zero the meter and put 3V rms in. Shunt down R4 to make the meter read full scale.

Switch to the 10V range and re-zero the meter. Put in 10V rms (if available) and shunt down R5 as necessary for full scale reading. If your rf source will not put out this much, you can assume that the meter scale is linear on this range, and adjust to make the meter read at the right point on the scale for the voltage you do have.



Close-up of the recalibrated meter face. Because four separate scales are required, a large meter allows direct calibration without the scales crowding together.

The meter may now be hand calibrated. Starting with the 0.03V range, recheck the zero and full scale readings of the meter as above, then put in levels of 5, 10, 15, etc., up to 30 mV, and write down the deflection on the original meter scale for each input voltage. Calibrate each higher range in the same way, using appropriate steps of input voltage. The meter scale may be drawn up by any of the usual methods, such as making an enlarged layout and photographing it. I drew mine up actual size, with a ball point pen on white card stock, and fastened it on the back side of the original scale with rubber cement. The finished scale is shown in the photograph. Since the scales get very non-linear at small voltages, separate scales are required for the 0.03V and 0.1V ranges. One scale can be made to do for the 0.3 and 3V ranges, by compromising a little, and one scale for the 1 and 10V ranges.

As an added refinement, you can tinker with the circuit to reduce the shift in meter zero when changing ranges. If there is much shift when switching between 0.3V and 0.1V ranges, try interchanging transistors Q3 and Q4. If the shift reverses when this is done, a better matched pair of transistors is needed. If it stays the same, a tiny adjustment of resistors R16 and R17 for better match is needed.

If the zero shifts when going to higher ranges, adjust the resistors R7 through R10 as necessary. The zero shift should be very small if they are made equal to the corresponding resistors R2 through R5.

The range switch may now be installed in its permanent location and the assembly of the instrument completed.

Use of Other Types of Semiconductors

The diodes in the probe should be silicon high speed types. As mentioned, the 1N914 is quite satisfactory. It is made by several manufacturers and is quite inexpensive, and there seems to be little reason to use anything else. If you have some others on hand you want to try, they should have something like the 4 nanosecond recovery time of the 1N914. For the 10V maximum range of this meter, a peak inverse rating of 40 or 50V would do; the 100V of the 1N914 gives a desirable safety margin. The bias diodes CR5 and CR6 should be the same type used in the probe.

The 2N4360 FET is a P-channel junction type. It is made by Fairchild and may not be as widely available as those of some other manufacturers. Other P-channel units may

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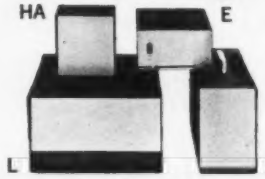

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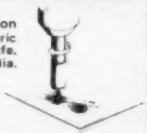

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be used; the main thing is to get or select some that have a fairly low pinch-off voltage, so that they will work at low enough supply voltage in the given circuit. N-channel types could be used also, but this would mean that the following transistors Q3 and Q4 would have to be changed from NPN to PNP types, and the polarity of all the diodes, the meter and the battery would have to be reversed.

The 2N3565 is a very high gain type; the ones in my meter have a h_{FE} (beta) of 275. This again is a Fairchild device. Other NPN transistors which look suitable are the 2N3117, 2N3692, 2N3711, 2N4124 and the 2N5131. A browse through the manufacturers' catalogs will turn up others. If you should change the circuit to use PNP types as mentioned above, the 2N3965, 2N4062, 2N4126 and 2N4250 are some of the possibilities. You could get by with less beta by using a more sensitive meter than 1 mA, or by doing without the 0.03V range; this would allow many more silicon types to be used. (Dropping that lowest range would simplify the circuit considerably as well.)

Conclusion

The frequency response of the completed meter was measured to be 1 dB down on the low end at 40 kHz. At the upper end, it was still flat at 216 MHz, the upper limit of the available signal generator. The input impedance of the probe was measured with an R-X meter; it proved to be 4 pF shunted by a resistance of 30,000Ω at 1 MHz. At higher frequencies, the capacitance remained 4 pF, but the shunt resistance dropped gradually, being 8,000Ω at 30 MHz and 1000Ω at 200 MHz.

With the 50Ω load attached to the probe, the meter will indicate rf power from a few microwatts up to 2W maxmimum. (Power equals E^2/R.) Without the 50Ω load, the probe may be used directly on sensitive circuitry, provided its 4 pF capacitance can be allowed for. Thus the meter will be found very handy for working on nearly all solid-state and other low power circuits.

Many thanks to Dave Annett WB6DBE for taking the photographs, and to Lloyd Provan for enlarging them.

. . .WA6NIL

Bob Manning K1YSD
Rye, NH

the "GREENIE"

The Wayne Green Award, or *Greenie*, came into existence in much the same way as did penicillin, the St. Andreas Fault and *me* – by sheer accident!

Recently, an obscure and nameless ham with the solder-wasting, foot-scarring and improbable talent of constructing breadboards with a propane torch, discovered his solder had been dropping into a scrunched-up, cast-off TV dinner plate secreted under his bench.

When – after several pounds had accumulated – the mass was removed and turned upright, it bore not only an amazing resemblance to Wayne Green (dutch boy haircut, turtleneck sweater and all), but two embossed letters, *E* and *L*, from the plate had been reverse fashioned into the glop somehow, making a passable *73*. Thus the *Greenie* was born!

Its destiny was to be awarded to the ham with the best – or most unusual – shack.

We (the awards committee), after visiting hundreds of shacks, were gathered in the huge 8 x 10 ft conference room to decide who should receive the coveted first annual Wayne Green Shack of the Year Award (no double entendre intended!).

To say it was an odd assemblage would be putting it mildly. It was, however, fairly representative. Wayne, himself, was in absentia – having gone off to fight simultaneous duels with the editors of *CQ* and *QST* (FCC Proposals at 300 meters).

Katrina of course was there, representing the YLs. Slightly over 300 pounds of Fem-Lib amateur radio operator, Katrina was – to say the least – imposing. A feminist to the last ounce, Katrina, at the moment, was banging alternately on the simulated alabster (plywood) table (Wayne spares no expense) and thumping Claude Zister, our technical type, on his emaciated chest, causing him to retch violently at each thump.

Claude isn't a bad sort, despite the fact that he and the slide rule he kept clutched in his bony fist were of unusually similar stature and weight. Only guy I ever knew who made Wally Cox and Twiggy look like Minnesota Fats and Mama Cass Elliot!

"It's gotta be a YL or XYL to win the award!" bellowed Katrina. "You male chauvinists have had it too much your own way for too long."

"Balls!" roared Grunt (at least I think his name was Grunt. He rarely spoke below 721 dB over S-9 which, when we first met, numbed my eardrums and I never was sure of what he'd said when he'd introduced himself).

During our inspection tour he yelled into one guy's mike so loudly and so excitedly that he bit the top right off a Shure 444. Grunt was the representative of that new breed of operation, The SuperHam! You've undoubtedly met them on the bands.

The SuperHam comes through, on the air, as a fiftyish, loudmouthed, know-it-all clot dedicated to the proposition that only *he* is created equal. He claims squatters rights to *his* frequency, and by virtue of thirty-two series paralleled 4-1000Z's simply opens up

and takes over at least 20 kHz of band width. Faster than a millisecond VOX, more powerful than the law allows, able to stomp QRP stations with a single belch. Ooh hoo! Look! There on the air! it's Aurora! It's insane! It's SOOOOPPERHAAAAMM!!!

"And again I say Balls!" roared Grunt. "It's gotta be a station with power, power, P.O.W.E.R. power and more power!"

At this point our secretary, Maggie (the message handler) began rummaging through an oversized Samsonite suitcase, the outside of which boasted – instead of travel decals – stick-on message check-off sheets, HX and ARL numbered references. "Wait a minute. I've got some notes here," she said, scattering message forms and blanks over her shoulder, the table and the floor.

"Yeah! Hold it!" chimed in Cecil, the certificate hunter, performing a similar act save for the fact that he was strewing certificates hither and yon. (Funny, I never did get used to Cecil's attire; the single breasted oversized WAS certificate for a jacket made from seersucker was bad. The bell bottoms fashioned from quilted CHC memorabilia was worse, but the tie that glowed in the dark showing his DXCC made me feel like someone was stepping on my throat.)

From the corner, Effram – our CW operator – was bleating, "Didah dididit, didah dididit."

Looking up from my navel (which, incidentally, in the last five years has gone from the outward type to the inward type), I began to pound my gavel for order. I, as the appliance operator-klutz-lid representative, was the chairman of this motley group.

"Order, order!" I screamed at the room, which had taken on the appearance of a ticker tape parade due to the fact that Maggie and Cecil were still flinging papers into the air. Katrina was hollering 'YL, YL, YL!". Grunt was bellowing, "Balls! Power-power-power I tell ya – ya gotta have power!" and Effram was driving me slightly off my rocker with that "didah dididit, didah didit!" It sounded like a Chinese auctioneer with a cleft palate conducting a sing-along for 200 babbling tambourine thumping chimpanzees.

Bang, bang, bang went the gavel as I pounded at the chaos. Suddenly I felt several sharp pains just below my spleen and discovered Claude poking me with his slide rule. "Excuse me, sir," he said, "but I believe you've just spilled your coffee into your lap."

"Thank God!" I exclaimed, "I thought it was something else."

Some semblance of order finally arrived except for Effram with his "didah dididit" and "dahdahdidah dah dahdidahdit."

"Grunt," I said, "will you put Effram on break-in and tell him to QRT."

"Huh? Whazzat, boy? You gotta speak up, boy! You need more power. More power, I say. Power, boy, slap the ole juice to it till the tubes run rosy red and the transformer fires – power, boy, power!"

Thankfully, Katrina took a hand and solved the problem with delicate feminine expertise. Clamping onto Effram's hand containing a soup spoon with which he was tappy-tappy-tapping something, she jammed both spoon and hand down his throat, coming dangerously close to his liver. Then, in what seemed to be a single motion, she grabbed Maggie's oversized attache case, and with a vicious arced swing whomped Grunt approximately 32 inches above his ankles – or – at the apex of his V, as we say in the trade.

"Okay," I continued, "now we only got this one trophy to give away. We've seen all sorts of shacks. Suppose we use the process of elimination? I think we can eliminate all the Danish Modern, Colonial and home-antiqued types, right? Any other eliminations? Raise your hands."

A sharp shooting pain under my left eye told me that Claude had raised his hand – replete with slide rule – damn near turning me into a cyclops.

"I think," said Claude, "that we can also eliminte the Japanese Contemporary shack. I mean, after all, 'Ladio Shack?' 'Landom Rength of LG/8U' and 'Loger, Loger OM' is a bit much; besides, the autographed 8 X 10 glossies of Sessue Hayakawa and Richard Loo in bamboo frames? Pfuii!. And how many operators will deliberately live on the side of a hill so they can erect slanted inverted vee's?"

"And it didn't got no power neither. No balls at all." chimed in a slightly falsetto Grunt, assuming a cross-legged protective pose as he cast a suspicious eye at Katrina.

"Yeah, and it was all commercial. He didn't have no home brew stuff anywhere!" came a voice from under the table.

"Who the hell is *that*?" I gasped, as a pair of hands and two eyes peered over the tabletop.

"Tis I, Marvin, the home brew specialist."

"Whatinhell are ya doin' under the table, Marvin, the home brew specialist?"

"I'm building a voting machine," Marvin replied, piling soldering gun, heat sinks, dikes and assorted other tools on top of a stack of Maggie's messages and Cecil's certificates.

"Look, old boy, I think I soldered my belt buckle to a table hinge, so I'll just sit here, okay?"

"Fer cripes sakes. Is that everybody?" I said – glancing around the room and under the table – absently noting that Marvin had, indeed, soldered his belt buckle to the table hinge.

"I believe," said Claude, manipulating his slide rule back and forth and making copious notes on a seemingly endless sheet of foolscap, "that we're missing one-point-three persons."

"Whaddya mean, 'one *point* three persons'?"

"Well, Baltimore-Anchorage-Roanoke-Rochester-Yokahama – what a name – the 20 meter, quick QSO kook was captured by an A&P manager and is working the 'five items or less' checkout counter around the corner. He was 'Hi there! You're 5 and 9 – that's a dollar 9.80 see you latering' to beat the band the last time I saw him."

"Okay," I said, "That's one – now what's the point three?

"Oh, that's Giggles. You can't really call him a full ham. I don't know what category he falls into. He's the fruitcake who checks into a net and spends the next 45 minutes tripping his VOX with giggles."

"I know the type. Thanks, Claude."

"Think nothing of it," said Claude, making a magnanimous arm-sweeping gesture, catching me across the bridge of the nose with that goddam ruler.

"I think you just deviated my septum, you ....."

"Didididit didit" "Didididit didit" came from the end of the table.

"Claude, why don't you go down and teach semaphore to Effram and take that mathematical pogo stick with you." I said, wiping a tear from my eye and a spot of blood from my nases.

"Okay, any more eliminations"

Katrina jumped to her feet (this act by its sheer spontaniety caused Grunt to explode backward against the wall – not an easy feat when you're in a 'September Morn' pose). 'I think" said Katrina, casting a threatening look at the folded-up Grunt, "that we ought to eliminate that Swedish Convertible shack also. Really! A Myra Breckenridge receiver and a Chrstine Jorgensen transmitter. That's carrying synthesis too far. No knobs, no meters no dials, no nuthin', just *one big switch* – or is that *swish*?"

"And it didn't got no power at all. Ya gotta have oomph, guts, punch. Ya gotta have balls!" said Grunt.

"And that thing just can't be made – no pun intended – it can't be made." said Marvin, absently rapping an rf coil around his athletic finger (the one that can make a broad jump!).

"I agree," said Claude, "the absence of a ball bearing drive mechanism on the vfo renders it virtually useless, and I think Effram will agree that a 'marshmallow key' for limp wrists is impractical. Right, Effram?"

"Didahdit didahdit" said Effram.

Just then a "giggle giggle" came from the intercom.

"Giggles, will you get the hell outta the waiting room, quit giggling into that intercom, and join us?"

"Right, Bob – giggle-giggle – but ya know I sort of liked that 'Liberal' shack we saw. You know the one – entire place bedecked hippie style with flowers, beads and black lights using a Lysergic 25 receiver, a MaryJane transmitter and a Horse Amplifier – hey, and the wattmeter labeled 'Flower Power' really IN the log books called a 'trip sheet' and all those petitions. Like the one petitioning all magazines to include a supplement to their "Who's Who"

columns entitled "Who Dat?" and that jazzy antenna – wow – erected in the form of a 65 foot peace symbol. That's today, Bob!"

"Oh, Lord!", I said.

"Charlie, Charlie" said Maggie.

"According to my calculations, the damned thing WON'T WORK, Giggles!" said Claude.

"Precisely! It's IN" said Giggles.

"Balls!" said Grunt.

"Do I record all this talk as one message or can I count each quote as a separate message?" asked Maggie.

"Hey, yeah! And do I get a certificate for attending this thing?" queried Cecil.

"Look, you band of three toed sloths, we're here to hand out this – this – this – ah – trophy. Now with the Emmys, Oscars, Grammys and all the other awards handed out, it's pretty hard to go through a lifetime without receiving an ward!"

"You're right, Bob. I know a guy who got an award for never having received an award!"

"Look, Marvin," I said. "If you can unsolder your belt buckle without doing yourself any permanent genetic injury, will you get up above the edge of the table, and we'll get this thing settled."

"Now," I began, "as I see it, in order to please everyone, we've got to give it to a YL running in excess of 10 KW on CW for quickie QSO's on 20 meters who receives an occasional BPL, has a good standing in the CHC and has built her entire shack in Early Halloween or Contemporary Junkyard all by herself and can giggle her VOX on phone, right?"

"Listen, BOY, are you out of your cotton-pickin' fumble-fingered Donald Duck-squawking mind?" said Grunt. "There ain't no such animal!"

"WHOOMPP!!!" Katrina struck again, knocking Grunt sidewise into Effram, into Claude, into Giggles and on top of Marvin.

From the resulting jumbled mass, horrible screams emerged and Grunt made a spectacular 7 foot leap into the air.

"Giggle, giggle," said Giggles.

"What now?" I said to a breathless, open-mouthed Katrina.

"Fer crissakes, Katrina," said a near hysterical Marvin. "What'd ya go and do that for? Now I got my belt buckle soldered to Effram's spoon and Claude's slide rule, I think I branded Grunt with a Texas B bar S and Effram is about to choke!" As if to emphasize this point, we could hear a tap tap tap thump thump thump tap tap tap as Effram rapped out an SOS on the table.

"Giggle, giggle."

"Oh Lord!"

We waded into a knotted mass of humanity. Calling on my old Boy Scout training we untangled everything but the spoon and slide rule which we left dangling from Marvin's belt buckle.

"Hey, you damned fools!" hollered Grunt from his position astride the water cooler. "We can forget the whole thing now. That dummy's soldering iron just melted the statue. Ain't no more Greenie. Ain't no award this year, unless you're planning on giving 'em a melted lead tea cozy or one helluva heavy frisbee!"

"Oh, Lord," I said. "Well, Wayne's always saying get the lead out. "

"Giggle, giggle."

"Maybe we could build a parabolic dish out of it," said Marvin.

"Put a number on it so I can log it." said Maggie.

"Hell, let's stamp BPL on it and GIVE it to Maggie " said Katrina.

"Can I keep it as a certificate " asked Cecil.

With extreme calm, I walked to the window and threw the melted glob, my gavel, the buckle-spoon-ruler combination and two handfuls of messages and certificates into the street. Then, as an afterthought, I picked up the still "didididit didit – didididi didit"ing Effram and flung him after his spoon, receiving the ultimated satisfaction of hearing him speak his first real word "HHEELLLLLLLPP!!!"

"Oh, Lord!"

"Giggle, giggle."

"Balls!" said Grunt, Katrina, Maggie, Marvin, Cecil, Giggles and I in unison. And, from the sidewalk, we heard "didahdit" thus putting an epitaph to the Greenie.

,,,K1YSD

John J. Schultz W2EEY
1829 Cornelia Street
Brooklyn NY 11227

RAPID RECEIVER CONTROL SWITCHING

A simple circuit that provides "touch" switching of various receiver functions for more rapid and easier DX-hunting.

Amateurs who are really interested in improving their receiving setup for DX-hunting or other purposes, usually end up with a receiver containing many modifications. These modifications, such as selectivity and preamplifier devices, may either be internally mounted in the receiver or contained in outboard enclosures. All the modifications may well prove their value in improving receiver performance, but one problem which usually develops is the control of the controls for the accessory circuits. The phrase "control of the controls" may sound a bit strange, but one of the greatest problems in DX-hunting with a receiver is to be able to concentrate on the tuning itself and not be distracted by having to look away to see the setting of other controls or, in fact, to operate other controls.

The simple circuit described in this article allows one to activate by touch control *any* receiver function which is *switch*-operated. The touch plates for different functions can be grouped around the receiver's main tuning knob, as shown in Fig. 1, so that one need not remove one's hand from the tuning knob in order to reach any touch plate. The choice of functions which one may wish to control in this manner is a matter of individual choice, but usually it will be such functions as i-f bandwidth, audio selectivity, sideband selection, etc. Placing a finger on a touch plate will activate the function for which that touch circuit is wired for a time period of 5–10 seconds, then the circuit function will automatically revert to its original state. This method of operation was chosen so that manual override of the touch circuit would be possible at any time by using the regular control switch for a receiver function. Also, the time period chosen allows sufficient time to operate the regular control switch if it is desired to retain the function that was activated and yet the time period is short enough so that, if the circuit function chosen proves not to be useful, it will drop out before too much reception is lost or distorted.

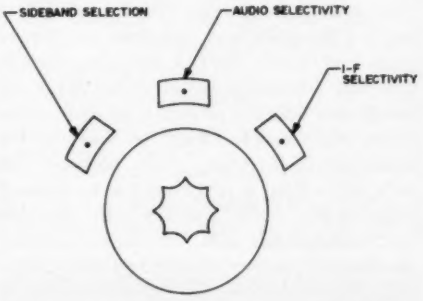

Fig. 1. Possible touch plate arrangement on the front panel of a receiver around the main tuning knob.

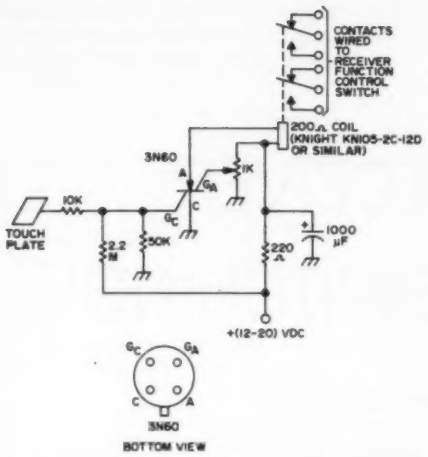

Fig. 2. Schematic of touch-control switching unit utilizing 3N60 or similar SCR. 1K potentiometer controls sensitivity.

Circuit

Figure 2 shows the simple circuit of the touch control unit. It consists of a basic SCR switching circuit utilizing a 3N60, or any similar SCR. Placing one's finger on the touch plate will provide enough pickup voltage at the cathode gate of the SCR so that the SCR will fire and the relay coil will be energized. Any relay can be used which has a 100–200Ω coil and does not require more than about 100 mA operating current. A 1 KΩ potentiometer placed between the anode gate and the power supply side of the relay coil can be used to regulate the sensitivity of the touch plate. Normally, the SCR when fired would continue to conduct indefinitely, unless a switch were provided to "unlatch" the SCR. To provide a means for the SCR to automatically stop conducting after a definite time period, power to the SCR is supplied via an RC network consisting of a 220Ω resistor and 1,000 μF capacitor. Once the SCR has fired it will continue to conduct until the charge on the capacitor decreases to the point where enough current does not flow through the SCR to allow it to remain in a conducting state. When this point is reached, the SCR will stop conducting. Depending upon the characteristics of the relay used, the relay will be de-energized shortly before or at the time the SCR stops conducting. Once the SCR stops conducting, the 1,000 μF capacitor will again charge via the 200Ω resistor. The value of the components for the RC network can be chosen as desired for the time delay desired.

Construction

It is suggested that the circuit first be "breadboarded" so one can determine the proper components to use for the RC network for the time delay desired. The value of the components will vary depending upon the relay used and the supply voltage. The final unit can be assembled on a piece of perforated board stock and mounted in any convenient location in the receiver. The supply voltage need not come from a well-filtered source and can be taken from any available source in the receiver. If necessary, a simple half-way rectifier circuit from the filament line can be used.

The most difficult aspect of the construction of the unit will probably involve that for the touch plate itself, since it involves the question of to what degree one is willing to modify the front panel of a receiver. The area of the touch plate need be no larger than that of a penny, or dime coin. Probably the best way to try the circuit for its usefulness, in fact, is to use something like a

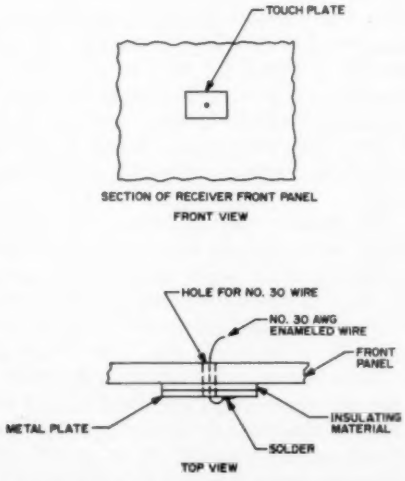

Fig. 3. Details of construction of a touch plate which can be mounted on a receiver front panel.

penny coin with a wire soldered to it as the touch plate. The coin can be placed on the receiver front panel near the tuning knob by means of double-adhesive backed tape and the wire from the coin run under or above the front panel. A more permanent and far neater installation can be made for the touch plate, as shown in Fig. 3. Any piece of metal sheet about the area size of a penny (not necessarily a round shape) is glued to the receiver front panel with an insulated backing of tape or other material. An extremely small hole is then drilled through the metal plate and the front panel just large enough to pass size #30 or smaller enameled magnet wire. The end of the wire is touch-soldered to the metal plate. In this way, if the metal plate is removed later, the very small drilled hole can easily be covered with touch-up paint, or other material.

The wiring of the relay contacts depends upon the control switch wiring in a given receiver. In most cases where simple on–off type control functions are involved, the relay contacts can simply be wired in parallel with the toggle switch contacts. In more complicated situations, as for instance when a multiple position rotary switch is used to set the receiver selectivity, the relay contacts must be wired across those positions of the switch for the two selectivity positions it is desired to alternate between using the touch switching. A study of the schematic for a specific receiver will reveal many useful ways in which the relay contacts can be wired into various control switches.

Summary

Touch switching of the most frequently used switch-type receiver controls can add a great deal of convenience to receiver tuning, especially under circumstances such as DX-hunting and contest work, where rapid control of various receiver functions is desired. Although touch switching is probably not the ultimate answer, it is at least a step in the direction of solving one of the major design faults with most receivers. That design fault, of course, is the grouping and nature of the controls for receiver functions not being really operator-engineered for rapid utilization.

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Installation couldn't be more simple. Outwardly, "Cloverleaf" is a small black box that connects between your existing 144 MHz FM transceiver and its antenna, also to the microphone and car 12 volt battery. You plug the 450MHz antenna into another receptable provided. SB-450TRC has no external tuning, no controls other than a switch that allows instant shift between the 144 and 450MHz ranges. No mods are necessary. **Your existing 144MHz transceiver remains intact.**

Transmitter-wise, SBE "Cloverleaf" is entirely **passive—draws no DC power yet delivers 40% of the RF drive at three times the frequency.** Example: 4 watts out on 450 MHz for 10 watts drive on 2 meters. This high efficiency frequency multiplication is accomplished by a power varactor diode in conjunction with multiple high Q tuned circuits. The 450MHz output is of course frequency modulated; overswing, due to frequency multiplication, being compensated by a fixed pad in the microphone circuit within the unit.

Receiver-wise, "Cloverleaf" has a front end with unity conversion gain that converts 450MHz band signals to I-F frequencies corresponding to 144MHz channels. Limiter, discriminator, output audio and loud speaker in the 2 meter transceiver continue to function in the usual manner.

Mobile wise, this all-solid-state transceiver is ideal—a compact box that can mount wherever space is available. "Cloverleaf" current drain is negligible.

Price-wise, this SBE high value/performance breakthrough represents worthwhile savings over the cost of a complete 450MHz transceiver with comparable characteristics. Truly, SBE has done it again!

SBE

· Unit with covers removed

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Hans E. Weber WA6QJU
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INCREASE YOUR SSB EFFICIENCY

add talk power to your signal.

The QRP people, like me, have two ends to improve their efficiency. One is the antenna, the other is the signal to be transmitted. Using SSB in the first place makes the station highly efficient. A good antenna system brings more gain than doubling or tripling the PA power.

How about the intelligence – the speech? Its average modulating performance is as bad as using a kilowatt with a poor antenna. To improve this, we first have to remove the "spikes," causing a low average modulation level or worse – overmodulation (trouble – TVI, RFI and other "I's"). Second, we have to compensate somehow for our inability to keep the volume at a steady level.

After a feasibility study, I ended up with the following solution (I had better say "we," because Hank Giunta and Jerry Stuart were a major support with positive criticism, and enthusiastic advice. I hereby thank both of them).

Table 1. Technical Data

Input mV	Output mV	Gain	Frequency Response:
5	130	26	100 mV input:
10	260	26	0 – 2 kHz 100%
20	460	23	2.7 kHz 87.5%
30	520	17	3.2 kHz 75%
60	600	10	4.4 kHz 50% of gain
150½	700	4.7	
300	800	2.7	
500	850	1.7	

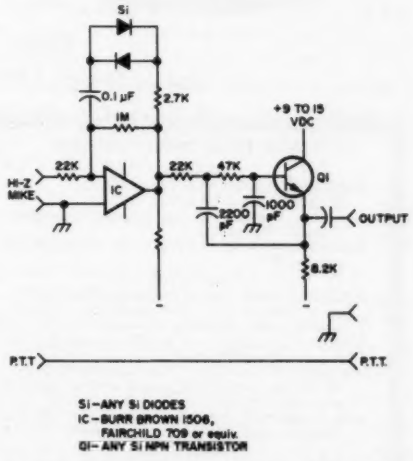
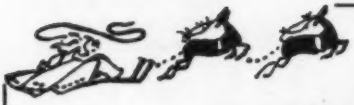


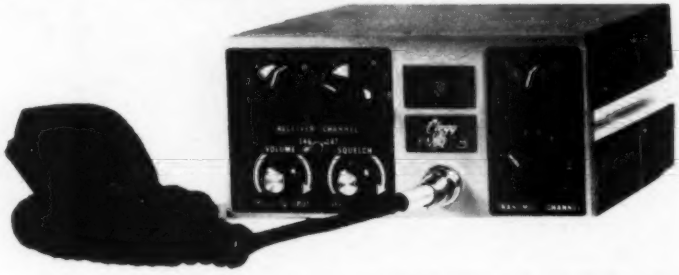
Fig. 1. Schematic. Si: any Si diodes; IC: Burr Brown 1506 or Fairchild 709 or equivalent; X_1: any Si NPN transistor; PS: + and – 9–15V dc.

This unit is in use as an "in-line" microphone amplifier and has given me a 10 to 20 dB "gain" from the receiving station for my HW-100 transceiver.

. . . WA6QJU



UP DANCER
UP PRANCER
DOWN FM-27B



Down to $429.95. . .The FM-27B Transceiver
During Clegg's 1-Month Factory Authorized Holiday Sale!

CHECK THESE SPECIFICATIONS

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POWER REQUIREMENTS: 12 to 14 VDC
Current Consumption at 13.5 VDC:
Receive: 4 amps squelched, 1.2 amps unsquelched.
Transmit: 6 amps max.

DIMENSIONS: 7 3/8" x 3 1/2" x 9 1/4" deep; 4 lbs. net weight.

RECEIVER

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SENSITIVITY: .35 μv max. for 20 db quieting; .1 μv for reliable squelch action.

SELECTIVITY: 11 KHz at 3 db; Less than 30 KHz at 70 db. Adjacent (30 KHz spaced) channel rejection more than 70 db.

AUDIO OUTPUT: 2.0 watts (min.) at less than 10% THD into internal or external ohm speaker.

TRANSMITTER

TUNING RANGE AND CONTROLS: Same as RECEIVER.

POWER OUTPUT: 25 watts Min. into 50 ohm load. P/A transistor protected for infinite VSWR.

MODULATION: Internally adjustable up to 10 KHz deviation and up to 12 db peak clipping.

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IDENTIFY THOSE UNMARKED ICs

You can't pick up a ham magazine or handbook nowadays without finding numerous articles on various pieces of ham gear utilizing integrated circuits. The trend is inevitable. ICs are inexpensive, require less building time and can pack numerous circuitry into no space at all. They are practically indispensable for building keyers, calibrators, converters, counters, amplifiers and signal generators.

There are basically two types of ICs on the market today, digital and linear ICs. Digital ICs, as the name implies operate on a digital system; i.e., ON or OFF like a common switch. This article will deal mainly with the digital IC as it is more prevalent on today's market and adapts readily to testing. A theoretical description of ICs is beyond the scope of this article but can be found in past articles. (For example, "Digital Logic Devices," N. Pos WA6KGP, *QST* July 1968.) Also, Motorola, RCA and International Rectifier IC manuals give easily understandable theory.

Since digital ICs are basically switches, they can be tested as such to determine their condition. Testing ICs prior to "plugging them in'' can be well worth while as one bad IC can damage others in the circuitry. Digital ICs are usually used in groups of three or more in many circuits so that each should be proved satisfactory before hooking them all together and throwing the switch.

Linear ICs on the other hand are analog devices. A linear IC chip is made up to provide internal biasing and steering diode circuits. These devices are readily used as AF-IF-RF amplifiers, discriminators, voltage regulators and balanced modulators with a minimum number of external components required. Testing a linear IC therefore requires much more elaborate test gear to check it out just as complete checkout of a tube or transistor requires gain, leakage, frequency response, distortion and other such tests.

Fortunately most linear IC circuits utilize only one IC or at least the IC circuits can be isolated from each other. Therefore, linear ICs can be checked by insertion in the actual circuit with input and output parameters measured without chance of ruining another IC in the circuit.

While testing linear ICs is not covered in this article, the identification feature of this article works just as well for either type.

Both types of ICs are readily available to anyone who has access to surplus flyers, electronic house catalogs or ham magazines. Outfits like TAB, Polypaks, Radio Shack and Meshna sell ICs one at a time to your requirements or in baskets of a dozen or more mixed ICs for the price of a six pack.

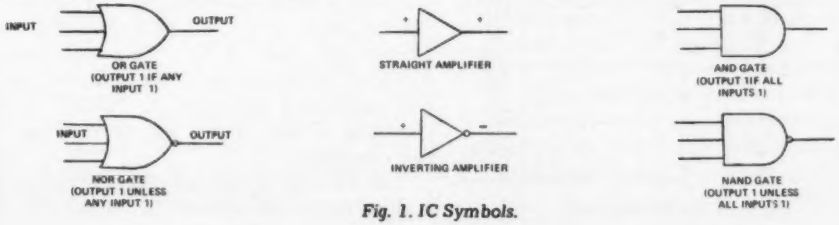


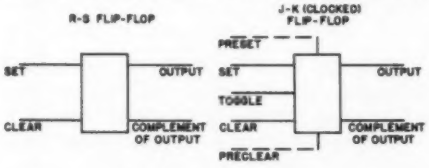
Fig. 1. IC Symbols.

This latter method is the obvious way to get started in ICs.

Identification

The first thing you have to do when you get your bag of bargain ICs is to figure out what they are. (Ever try to use a tube with no number on it?) Sometimes this may be easy if the IC comes with some descriptive literature telling what it is, its pin connections and ratings. More often than not, though, you ll just get the IC and it may or may not have some letters, numbers or both on it along with maybe the manufacturer's name or trademark. If you get any with no markings at all, deep six them as they aren't worth the effort. With the number and manufacturer pinned down, merely drop a card to the manufacturer and most will be glad to send you a description of the device.

If only letters and numbers appear on the device, you're in for slightly more work. Check the prefixes listed on Table 1 and see if you can match your device number with one on the chart. (You'll note some prefixes are used by more than one manufacturer so check entire list.) If this works, again write manufacturer. If not, check some IC replacement guides like Motorola's HEP, RCA's SK series or International Rectifier's IC guide to see if you can uncover the rascal's identity. If all else fails, you can try to obtain a copy of the latest Electronic Design News Semiconductor Annual which seems to list them all. Again remember what you paid for these devices and decide how much effort they're worth.



IF THE SET INPUT IS	AND THE CLEAR INPUT IS	THE OUTPUT WILL
⏚	⏚	NOT CHANGE STATE
⏚	+	GO TO THE ⏚ STATE
+	⏚	GO TO THE + STATE
+	+	GO TO THE ⏚ STATE

IF THE SET INPUT IS	AND THE CLEAR INPUT IS	AND THE TOGGLE IS	THE OUTPUT WILL
⏚	⏚	+ ⏚	CHANGE TO THE OTHER STATE
⏚	+	+ ⏚	GO TO THE ⏚ STATE
+	⏚	+ ⏚	GO TO THE + STATE
+	+	+ ⏚	NOT CHANGE STATE

Fig. 2. IC flip-flop symbols.

Testing

Now, assuming you've found out what it is and its pin connections, you're ready to check it out. For all types, first set up selector switches for Vcc and ground connections. (The two voltage ON-OFF switches should be left off until the setup is confirmed.) Set the output pin to the "meter" position and leave all others set to the "OPEN" position until you're ready to test.

For AND (NAND) and OR (NOR) gates, see Fig. 1 for normal operation and set the inputs of the gate to either "GROUND" or "1.5V" depending on the type of gate. Then switch "ON" the 4.5V and 1.5V supplies. Observe the meter for pickup or dropout of the output signal. Try all possible input combinations and make sure the output responds as required.

Many ICs contain two or more discrete circuits in one package so be sure to check all of them.

To check an amplifier (called "buffer") apply input signals and observe the output for straight through operation or inversion (output opposite input).

Flip-flops will be the most involved ICs to check out due to their varied functions. Truth tables for the two most common type of flip-flops, clocked J-K and R-S, are shown in Fig. 2. These are only typical truth tables so check the one for your particular device.

Understand the tables thoroughly prior to attempting to check a flip-flop as they can be ruined quickly especially if a positive voltage is inadvertently applied to an output that is in an OFF or DOWN state.

The R-S type merely requires setting up the various input combinations and observing the output Q or $\overline{Q}$ (Q not) to see that it follows the truth table. When checking flip-flops, always set the unused output (the one you're not metering) to "OPEN" as grounding either output will prevent flip-flop operation.

The J-K type is checked similarly except nothing happens to change the output state

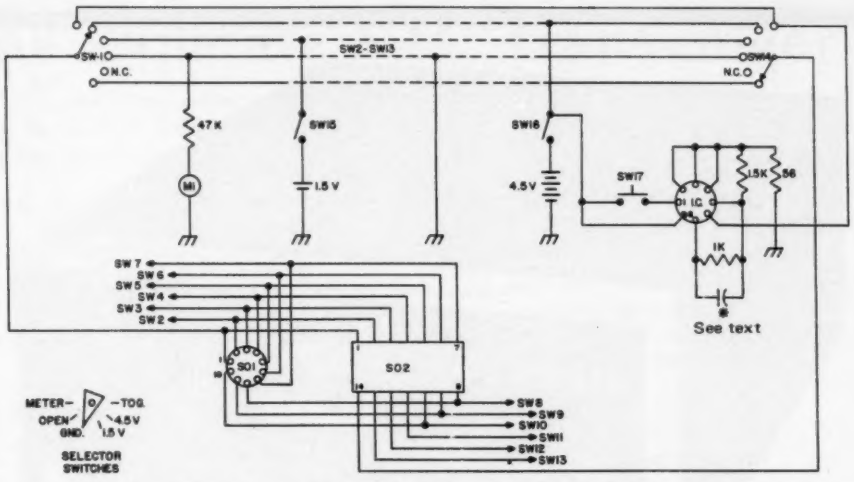


Fig. 3. IC tester schematic. M1—100 μA, SO1—10 pin IC socket, SO2—14 pin IC socket, SW1 thru 14—1 pole 6 pos. rotary, SW15, 16—SPST toggle, IC—μL 914, SW17—N.O. pushbutton.

until a signal is applied to and removed from the clocked input (usually labeled "T"). Therefore, the various input conditions are preset one at a time and after cycling (ON-OFF) the clocked input toggle button, the output is observed for conformance to the truth table. Most clocked flip-flops require a shaped clock input. A Schmitt Trigger circuit is included in the tester to provide the proper clocked waveshape.

Any flip-flop may have a direct set and/or direct clear input which override any other inputs. No matter what inputs or clocked signals are applied, a direct set (Sd) input sets the output (Q) high and a direct clear (Cd) input resets the output (Q) low. Be sure to check all these functions before declaring the device good.

The IC tester shown in Fig. 3 is simple and parts layout is not critical. Rotary or lever switches can be used for pin setup selectors although 6 position lever switches are hard to come by. Follow the switch sequence shown. If your Schmitt Trigger output does not operate a flip-flop toggle input consistently, add a 100 pF capacitor across the 1K resistor in the Schmitt Trigger.

If you have to switch an output pin through a voltage position (1.5V or 4.5V) during a test, turn the supply switches OFF until completing the change.

Any meter indicating 5 or more volts will work. I had a 100 μA meter on hand and series-mounting a 47K resistor with it resulted in a 5V movement.

The number and type of IC sockets depend on how many types you want to test. My tester has a 10 pin circular (works FB for 8 pin devices) and a 14 pin in-line socket. If you plan to test any 16 pin in-line devices, I suggest adding a separate 16 pin socket rather than trying to use a 16 pin socket for both 14 and 16 pin devices. This would throw off your selector switch numbering.

Flat-pack sockets are also available and its addition will be well worth while as flat-packs are becoming very plentiful on the surplus market.

I use a penlite battery power supply although a well filtered ac supply is just as good.

Conclusion

The use of ICs can help build up your shack accessory shelf with a minimum of construction time. By taking advantage of the IC bargains available today and eliminating frustrating hours of troubleshooting a project that won't work by checking the ICs beforehand, the "appliance operator" tag can be shed forever.

.. WA6IGU

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THE QSL FROM BY-LAND

Last summer, the Island of Okinawa was being subjected to a typhoon that was using its rains and wind to shut everything down. For two days I had been off the air because the antennas were lowered to prevent winds of 80 knots from turning them into a mass of tangled wire.

I was deeply absorbed in a rather old medical journal when the phone rang. An old pal of mine, Bob Martin, was sitting at the Naha airport, waiting for the weather to lift. He was 24 hours out of Burma and trying to get back to the U.S.

A 30-minute ride through pounding rain, several seconds of handshaking and backslapping, a second ride of 15 minutes, and we were seated in a comfortable military club. After ordering drinks, Bob explained he had been working for the past three months in Northern Burma for a private geological firm. The pay had been excellent and armed guards had been provided for his safety.

He finished half his drink and began to unfold a story that still leaves me with a cold feeling.

"After being briefed in Rangoon for about three days, I was flown to Myitkyina in Northern Burma. I began my soil studies while the guards set about erecting bamboo huts. The first night we had visitors, but a few rifle shots from the guards dispersed our would-be thieves.

"For the first two weeks, the geological aspects of Burma kept me quite busy. As the routine began to slow down, I turned to ham radio. In the trunks and cases of supplies I had included one of the latest 2 watt, printed circuit transceivers which would run off one of the truck batteries.

"I had purchased this little QRP rig for a little 80 and 40 meter SWLing in the evenings. After a hard day of work, I'd bathe, dine on canned beef and rice and put my ear phones on for a few hours. The antenna was a thin wire strung from tree to tree with a length of about 60 feet. Forty meters was a mass of static, QRM and JA stations, so tightly packed they resembled a can of worms.

"One night on the low end of 80 meters, I heard a loud, T6 CW station testing. It must have been within a few hundred miles, but no call sign was given. The following night the same signal was on again, but the buzz and chirp was sending out Morse code . . . . de BY1**. I cannot use the call sign in its entirety because of later events that took place.

"On the third night he was there again, but there was a CQ followed by BY1** about twenty times.

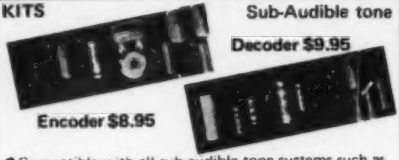
"I had only three days left in Myitkyina (which is about 50 miles from the China border) and in a week I would be heading back to the U.S. Would I dare answer the CQ of a fellow ham? I spent the next day constructing a crude key from strips of metal and wood. A quick test showed that I was putting about one watt or less into my antenna on 80 CW.

"That night I waited to give BY1**/XZ. Not quite legal, but in this case the radio amateur spirit was beyond law.

"He came back to me. He was only able to repeat his call and something that came over as Ten—ng. A quick check on a map showed this to be Teng Chung, his QTH, which was about 75 miles east of me. I gave him my first name and QTH (I would be out

KITS

Sub-Audible tone



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of there in a matter of hours). The QSO ended as his signal dissolved in a final chirp, a few buzzes and then silence. He appeared to be having rig troubles.

"I was a happy man that night as I drifted off to sleep. About 1 AM the guards fired a few shots at the ever present, but elusive thieves.

"The next night, I gave him another call. He was there all right, but his rig lasted only long enough for him to repeat . . . "QSL" . . . and then it stopped.

"On my last night, there was no sign of BY1**. I had less than 24 hours left before I was due to leave Burma and most of this time would be devoted to packing. Shortly before dawn, I was awakened by rifle shots, a rushing of feet and the guards yelling at me to come outside. They had shot and killed one of the thieves. The poor devil was dead beyond doubt, two shots in the chest had finished him. There was a small packet of papers in his pocket. I collected these and went into my hut to examine them under the kerosene lamp.

"Sorting through the crumpled and bloody papers, I received the shock of my life, for before me was a QSL card from BY1**. It was home made, had his name, QTH and was addressed to my call sign. The body lying outside was BY1** who had crossed the border to Burma hoping to deliver the QSL to me. I was physically sick for the first time in years, I wept.

"We buried him near the camp, his grave marked with a stone engraved with BY1**."

Bob Martin's story was finished. I was deeply moved, I had nothing to really say. I drove him to the airport and as he was preparing to board the plane he made a final gesture. He handed me the battered and stained QSL card of BY1**.

"Doc, you take this. Keep it out here in Asia."

I was about to argue with him that he should keep the QSL, but Bob dashed into the plane.

I had the QSL framed and keep it in my shack here in KA6 land. The next time you're in Okinawa, stop in, I'd be proud to show it to you.

. . .KA6IX

John S. Hollar Jr. W3JJU
377 Rumson Drive
Harrisburg PA 17104

A TWO-TONE SEQUENTIAL SELECTIVE CALLING DECODER

It beeps your horn . . . has a message lamp and sounds like something out of Star Trek.

OK . . . so the repeater is getting jammed up and all that nonesense is getting on your nerves. Squelch circuits have been acclaimed as the greatest thing since cheap monitor receivers. With noise pollution on the rise, some peace and quiet helps to produce less fatigue on the ears. Repeater cliques have developed to the point where a more sophisticated selective calling device might fill a very attractive need to those who require constant monitoring but without all the "chit-chat." The device to follow is interesting to use because it sounds so professional and works very nicely at a low cost. It can be made up for single tone decoding or a two-tone unit as is. Whatever you need, the small size and low power requirement will allow use with most modern two meter transceivers as well as a host of surplus mobile units.

The Alert Tone

When called by a fellow amateur, the only thing that happens is a three second LOUD warbling tone which triggers independently from the trigger tones and shuts down three seconds after the final tone. The first and second tones must be of a one second duration each. Any shorter and no trigger . . . any longer and the tone goes longer. During breadboarding a sonalert was considered, but because of high cost and size, it was given up in favor of the warbling alert tone. Using inexpensive import parts and a UJT, an alert tone unit is the result with a rather unique power oscillator for audio. The resulting signal is both pleasant and modern sounding.

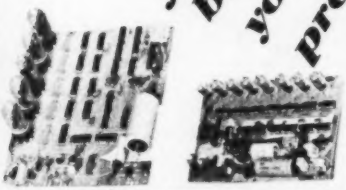
The entire resting current for the alert tone is 2.5 mA and when signaling it runs about 25 mA.I was amazed at how loud the tone was for so small a current drain and checked it several times to be sure. The 33K resistor and the 25 μF capacitor in the UJT gate sets up a sawtooth pulse which is (slow switched) used to forward bias Q10 at the same rate. Since the frequency of this oscillator is dependent upon voltage, the base of Q10 varies the voltage feedback path to the audio transformer and a warbling rate is established. Any number of assorted alert tones may be selected by attaching a 10 μF capacitor to any of the components in the UJT to ground. Any attempt to switch this audio by anthing other than a relay was futile and resulted in a slow takeoff and a dying effect that sounded just awful. Since an extra set of relay contacts exist on the horn relay, it presented no problem to switch on the alert tone mechanically and the end result is a sharp "on-off" effect when receiving a call.

Frequency Selective Reeds

The decoder derives audio from the receiver from any convenient source either squelched or unsquelched (which makes the unit ideal for the Twoer). After clipping (if required) and suitable amplification from Q1, the emitter follower drives two G.E. Tone Reeds in series. My original experiment used this same set up for the Motorola Vibrasponder reeds although these are not really reeds.

The difference is that the G.E. reeds give a mechanical vibrating contact closure when

now there is no excuse for not building your pet project!



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You must supply the cabinet, A.C. cord, meter, switches, etc. on all kits except where noted otherwise. (All prices are postage paid – we pay shipping.)

If you have been putting off building because of circuit board layout, you have no problems . . . just send a schematic to PEMCO and we will design and build your circuit board to your specs using high quality G10 FR4 2 oz. copper and tin plated for long resistance to oxidation.

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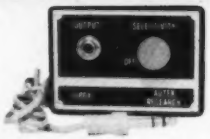

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Fig. 1. Motorola and GE tone reeds.

the primary driving coil receives audio energy at the exciting frequency. In order to derive a usable audio waveform or pulse for decoding purposes, the G.E. Reed requires some switching voltage. It works very much like a synchronous vibrator, in that supplying dc across the normally open reed contacts, when vibrating, produces a very ragged waveform equal to the exciting frequency.

The Motorola TLN series of "reeds" (see Fig. 1) actually does the same thing but acts more like a frequency selective voltage generator. When excitation audio reaches the design frequency, a vibrating element which must be magnetized induces a very small voltage in a secondary coil which then can be amplified and rectified by later stages. Here the waveform is a pure sine wave. In any event, either reed can be used in the circuit and the pc board was designed to use the G.E. reeds because they are smaller, less expensive, and produce a gain over the TLN type. If the Motorola reed is to be used, eliminate the voltage drive and the RC filter and think of it as a transformer, grounding one side of the secondary and driving the .2 μF with the other side of the secondary. For two-tone operation the primaries may also be in parallel with the emitter of Q1.

As an after thought, the frequency selective relay used in remote control airplane work, will work very nicely and can be driven directly from the receiver speaker eliminating the need for Q1. These five-tone relays are available from Lafayette Electronics and require the G.E. voltage derived circuit. Since these relays tend to be lower in frequency, by carefully removing the tine mounting, the tine lengths can be filed to a higher frequency but don't go much beyond 800 Hz, because the contactor is mounted too far forward for a good "make."

The Basic Decoder

Once the frequency selective element has

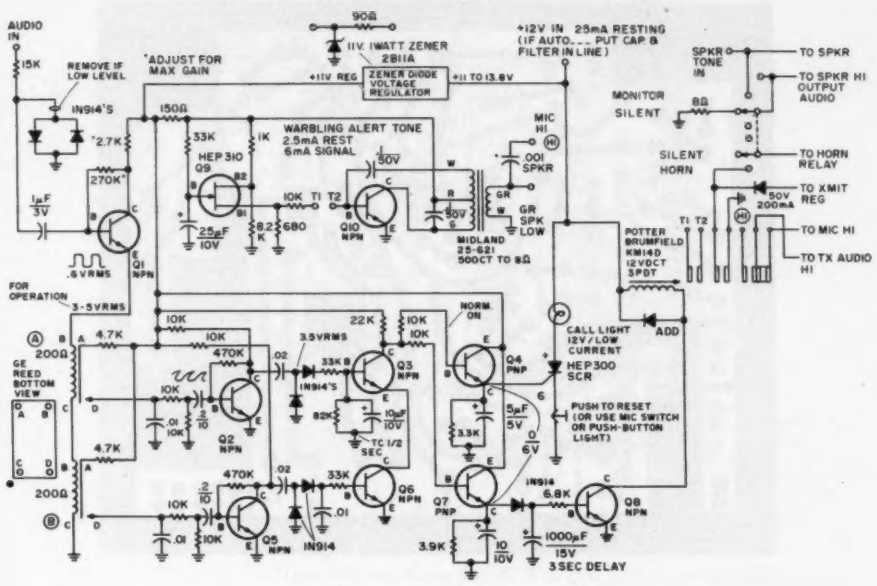


Fig. 2. Schematic of the decoder.

been selected, the corresponding output is amplified by Q2 (for tone A, the first tone in sequence) and rectified. Notice that a 10 µF and 82K time constant has been added to the first tone dc output. This RC network prevents trigger on anything but the proper tone sequence, allows Q3 to conduct long enough for the second tone to arrive through Q5 and Q6 . . . and prevents reverse tone signaling; i.e., where the tone sequence is reversed and the same two tones are used. This feature allows a simple two tone encoder to signal two decoders by alternating tone sequence, and permits a simultaneous "all-call" when the tones are sent together in a two second burst. Q3 and Q6 form a basic AND gate which only conducts when both tone signals have been received. Since this point is very brief, the result is a sudden dip in the outputs of Q4 and Q7 which cut off momentarily. When Q4 cuts off, emitter voltage increases sufficiently to fire the SCR and the lamp circuit.

Lamp current which must be in the "holding" range of the SCR will then hold the SCR "on" giving a call lamp. Other functions can be designed into this hold function such as starting a timer for a tape recorder.

The other control function also derives its voltage drop from Q3 through the other 10K resistor which provides isolation between the two trigger stages. Q7 uses a similar emitter follower which provides a healthy voltage spike from its cut off. Here the voltage passes through the diode, is used to charge the 100 µF capacitor and bleeds slowly through the 6.8K resistor holding Q8 into conduction for about three seconds. This type of delay circuit is attractive because it is inexpensive and is fairly reliable. The diode is required to keep the capacitor from discharging back through the emitter of Q7. The net result is a delay-relay which is activated by a one half second burst. If more time is required, increase the capacitance or, being careful to keep Q8 conducting, increase the bleeder resistor. Stretching this

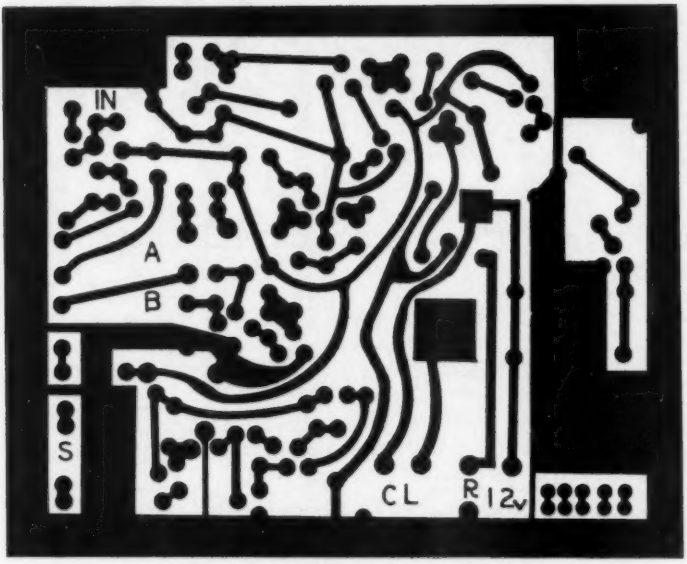
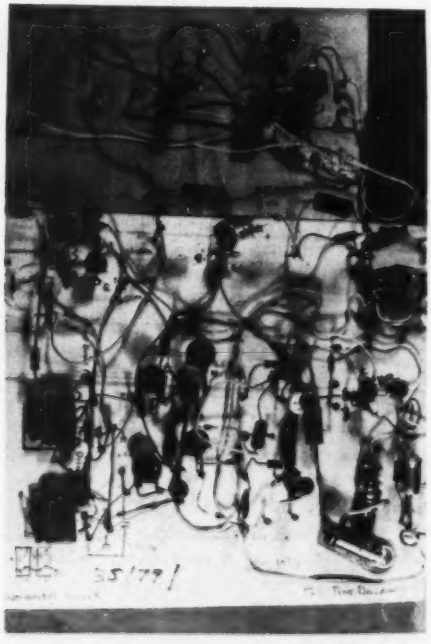


Fig. 3. PC board, actual size (foil side).

delay circuit to maximum with a 12V supply and a half second pulse, I was able to get about twelve seconds with the relay specified and a transistor of average beta.



W3JJU's original bread-boarding of the circuit.

Breadboarding The Final Design

The project was initially breadboarded. It was designed from basic transistor knowledge as I went along. I was surprised at how much fun it was to grab a piece of wood – pound a few wire brads in, and solder the parts together. Usually when trying out a circuit, I do everything without the board, ending up with a pile of soldered components which might have more practical value in an art show. Avoiding the electronic sculpture technique permitted the use of far more junk parts which were easily clipped in and out during experimenting. Breadboarding this way really saves time and is worth the effort.

The next step was to copy down the circuit, design the pc board and mount the parts. Throughout the design, only surplus capacitors and transistors were used. The transformer is a standard 500Ω to 3.5Ω and is made by Midland.

The board size will fit snugly inside most small receivers or control heads or can be side mounted in a box containing the horn switch, hook switch for the microphone and call lamp and reset button.

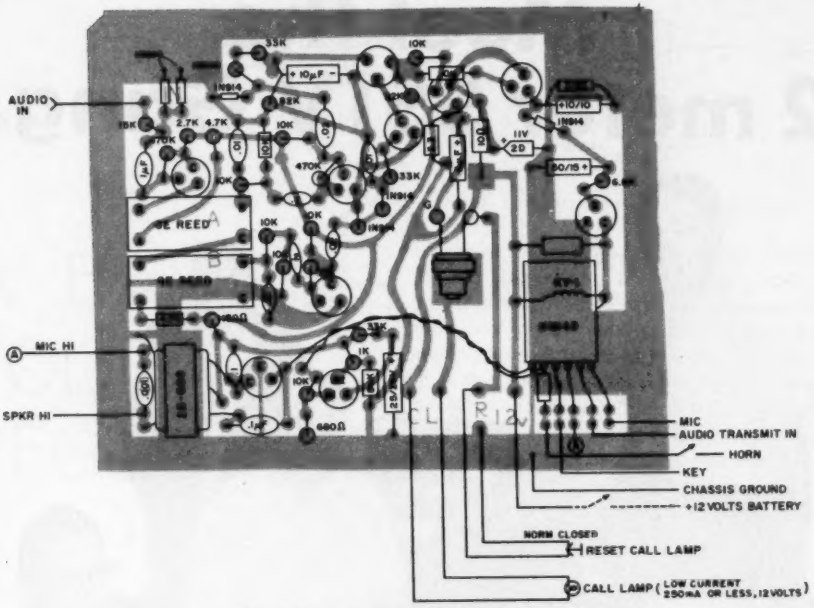


Fig. 4. Parts placement on the PC board.

Applications For The Decoder

Once constructed no adjustments need to be made – it either works or it doesn't. Check each stage of audio and measure dc. A good scope will point out the problem if any. All testing was with an old car battery and the heavy current stages, the lamp and relay, are isolated from the decoder through simple zener regulation. This helps to prevent falsing when starting the car or if car generators are hotter than the average. The Potter-Brumfield relay is expensive (about $5.00) but is very small for a 3PDT relay and provides many uses:

1. Connect one contact through a single pole switch to the horn relay in the auto. Connect the other contact to ground. When the decoder signals, the horn will blow for three seconds, and may be disabled with the switch.
2. Likewise, the SCR can switch on the dome-light for nighttime silent alerting and may be cut with a switch.
3. Shunt the audio output from the receiver to speaker through an 8Ω resistor and drive the speaker with the decoder alert tone. Use a microphone "hook switch" so that when the microphone is "on-hook" the speaker is muted. You now have the same type of system as a home telephone.
4. I haven't checked the legality (and I don't intend to use this) but some mobile services other than amateur use a call verification signal. This can be provided by keying the transmitter from the decoder relay, and switching the warbling tone to microphone input. When signaled, the mobile unit switches on and transmits the last two seconds of the warbler so that the calling party knows that received party has his unit on and his call was received. If nothing comes back, don't bother wasting airtime calling. His unit is probably off.

It was mentioned earlier that the unit could be used with a single tone. By using one reed and grounding the emitter of Q3, the decoder will respond to a one second single tone burst. Building and using a decoder can provide an interesting and professional touch to an average "open mike" repeater system. It reduces the strain of increased VHF activity, which should reduce the complaints. After all if you don't hear 'em, you don't have to work 'em!

. . .W3JJU

Meet the 2 meter SSTV Gang.

From left: Bill Arrowsmith, W6TEZ; Judge William Ritzi, W6OWL; Judge Pearce Young, WB6HWY; Byron Paul, WA6RNG (Producer-Director of the Dick Van Dyke Show)

that's right... 2 meter SSTV

Shown above are four hams who have had so much fun working SSTV on 2 meters and 220 that we asked them if they'd make a few comments about it for one of our ads.

We went up to Los Angeles (where they all operate) and chatted with them a bit. They all agreed that one of the biggest enjoyments of working 2 meter SSTV is the new dimension it adds to 2 meters, far more interesting and creative than operating radio alone.

They noticed a steadily increasing SSTV activity on 2 meters, observing that there must be 50 or more operators working SSTV on 2 meters or 220 in LA alone.

One observed that working DX doesn't offer the challenge it used to, since you can buy all the power you want, . . . "So where's the challenge. SSTV is the new challenge!"

They work a schedule once a week or so, and have little problem in raising SSTV contacts. "In fact, everytime we get on the air," Judge Ritzi noted, "we have break-ins from a lot of hams wanting to know more about SSTV."

And a bit of information that hadn't occurred to us; their families really get interested in SSTV. They all enjoy it, and often work together preparing the art work and pictures for the production of their 'TV' shows.

We were very grateful for their comments, and, for the time they gave to us. Thank you gentlemen.

We can't guarantee that you'll appear in one of our ads when you begin working SSTV on 2 meters, but we're pretty sure we can guarantee you as much enjoyment as our "2 meter SSTV Gang" from Los Angeles.

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A BASIC VOLTAGE REGULATOR

Remember transistors? They do a fine job when ICs aren't handy.

One of my recent electronic efforts was full of TTL devices and needed a regulated five volt supply. A search through the junk box showed that I was out of my usual collection of IC regulators. I don't know about your junk box, but if it is anything like mine it concentrates on the fundamentals – the essentials: transistors, resistors, capacitors and little else. Every so often I have a fairly good stock of ICs but unknowingly, some innocent project always depletes my supply. This, I realize, is evidence of inefficiency. C'est la vie. Another check indicated that my zener diode supply was in no better shape.

Naturally, I had drawn schematics and sketched pc board layouts before I found that I had no parts to fit, but all that work at least makes you think a little about how a circuit works. And a voltage regulator minus frills really only consists of a few elements. A pass element, usually a transistor; a reference element, generally a zener diode; and a comparison and control amplifier which compares the output voltage with the reference voltage and whose output then causes the pass transistor's resistance to vary in such a way as to keep the output voltage constant. See Fig. 1. The frills, although sometimes necessary, (current limiting, temperature stability, rapid response, etc.) were not really needed for my application.

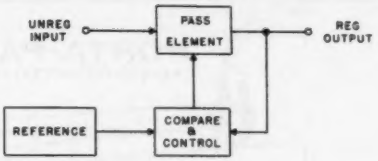


Fig. 1. Elements of a series voltage regulator.

There was no parts problem with the control amplifier and pass element since I was liberally stocked with transistors but the reference element was the stumbling block. In Fig. 2 the current/voltage diagram illustrates the operation of a diode in both the forward and reverse conduction regions. A zener diode depends on the reverse conduction region for its operation; when the reverse voltage across the diode exceeds a certain value the diode breaks down and the voltage remains constant for wide ranges of current. In order not to destroy the diode the current must be limited to a safe value by a series resistor. For example, if you had a one watt zener diode and the breakdown voltage was ten volts then the current must be limited to 1/10 ampere or 100 mA to stay within the power rating of the diode.

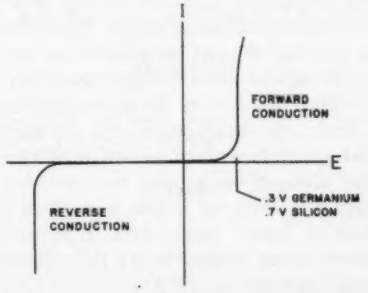
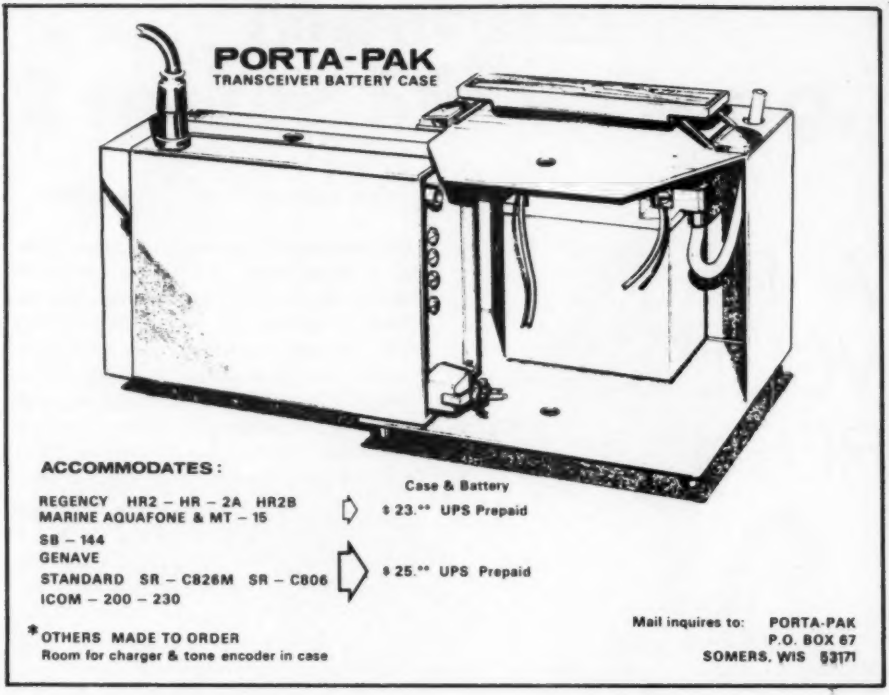


Fig. 2. Junction diode current/voltage diagram.



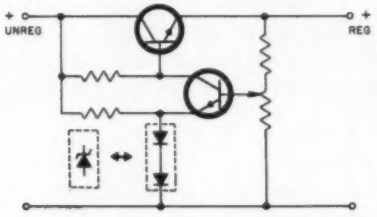


Fig. 3. Forward biased diodes replace zener diode as reference.

Also for a wide range of currents a diode shows a relatively constant voltage drop in the forward conduction region. This voltage drop is about .3 volts for germanium and .7 volts for silicon diodes. Slight variations in this voltage are due to the current through the diode, the temperature, and the doping of the junction material but it can be a good stable voltage which may be used for a voltage reference. So if you want, you can replace a zener diode with a string of forward biased diodes to get the reference voltage you need, as in Fig. 3.

It is possible to go one more step in this direction and wind up with the voltage regulator I used, which is illustrated in Fig. 4. This circuit utilizes the forward biased base-emitter junction (a diode) of the control amplifier as the reference element and reduces the component count to a satisfying minimum. I used PNP transistors to get a negative regulated voltage, but NPN transistors could be used to obtain a regulated positive voltage output. If additional regulation is desired another stage could be added to the control amplifier. A common way of accomplishing this would be to darlington connect a transistor to the pass element. However, in such a situation, I would recommend going the IC regulator route.

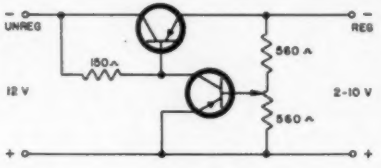


Fig. 4. Base-emitter voltage as reference.

. . .KL7EVO

Melvin H. Dunbrack W1BHD
30 Greenleaf Street
Malden MA 02148

TAKE-APART 2 METER BEAM

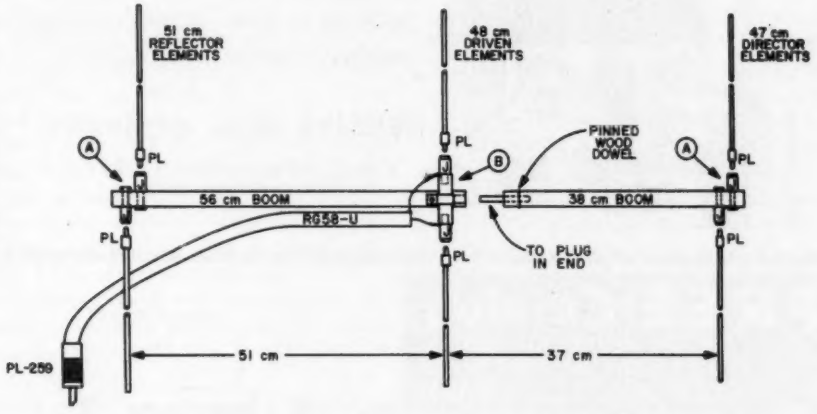


Fig. 1. The 2 meter beam. All elements are measured from center of boom.

Here is a portable, take-apart two meter, three element beam for FM that can be disassembled and stuffed into a long umbrella case for ease in carrying around. It stirred up the Boston area boys and they wanted more information on it. It features simple construction using junk box parts and is FB for walkies and portable operation. Supporting the beam may be done by various methods. Some have used rope to hang it from the ceiling, attached it on the wall, or, in the case of Tony K1VTE, on his shoulder while walking around with his Tempo, ignoring the wild-eyed onlookers.

The main boom and the take-apart extension was scrounged from ½ in. (std) aluminum tubing – which in our case were the leg supports from a discarded portable metal snack table. If you have any of these around the house, maybe the XYL will donate one for the cause. The six elements are from 1/8 in. (std) brass rod with the ends threaded 6/32 to fit into the banana plugs. They could also be soldered in. Millen #37222 binding posts are used for the jacks, and fitted in the holes in the boom and secured

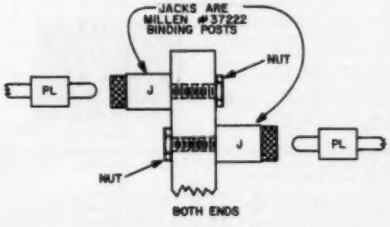


Fig. 2. Details of end elements.

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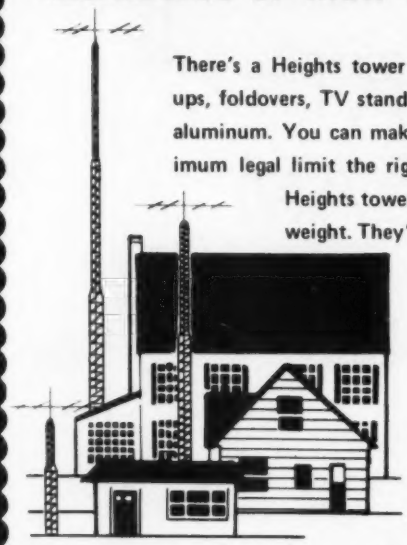

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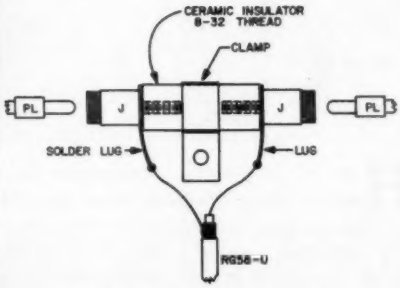

Fig. 3. Driven element details.

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with 8/32 nuts. The slight offset of these jacks at each far end of the boom does not materially affect the performance. The ceramic center insulator is a surplus unit with 8/32 threaded holes to accommodate the binding posts. The threaded ends of the posts are shortened a bit so they will screw down tight to the center insulator, securing solder lugs or clips for the coax feed.

It works like a charm and the compactness is a bonus for people who travel.

. . .W1BHD

John A. Carroll K6HKB/1
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MAKING THE MOST OF AUTOMATIC IDENTIFICATION

Wayne's editorial in the September 1972 issue lit my fire when he got to automatic identification. I've been talking up an automatic calling and alerting system for a long time, and it looks to me as though one black box could do the ID job as well. The requirements are very similar. I pulled an old paper out of the files, and it still looks relevant.

Briefly, the idea is to set up a single calling frequency in each band. Anybody wanting to contact a specific station would send a digital word giving the calls of the station called and the station calling, in a coded form. An autocall-equipped station would have a black box connected to the receiver, constantly monitoring the calling frequency. It would ring a bell when it recognized its call.

Most of the logic required to transmit a digital call is the same as that needed to receive it, so it makes sense for one unit to do both. Now we throw in the self-identification (SID?) function, and the unit proceeds to take over the transmitter whenever the rule says it should. It sends only the half of the autocall transmission that contains identification. Naturally, this happens on the working frequency.

Since identification comes right after the start pulse in the SID transmission, it makes sense to invert the traditional ham calling procedure and begin the autocall transmission with the identification. Makes the logic simpler.

A standard, machine-readable form of calling and identification opens up all sorts of possibilities. Besides the DXpedition speed-up, there are DX autopatch, distress call monitoring, computer-controlled real-time Teletype traffic nets, automatic repeater chaining, and whatever else a quarter of a million fertile and fiendish minds can invent. I would like to make a partisan statement at this point, to the effect that I have only emotional sympathy for those who would like to freeze ham radio into the techniques and atmosphere that built it through the twenties and thirties. It's always been fun, but a little judicious use of automation could turn it into a really useful and dependable emergency communication system for the public, which has always been an unfulfilled dream. What we have now is analogous to a telephone with no bell.

The rest of this article is the meat of the original paper on the autocall code, slightly modified to take SID into account.

The idea is to encode a ham call in a way that is easy to learn, while keeping the hardware simple. This way, we eliminate the need for a catalog to relate a call to a binary number.

Morse code can be rejected out of hand. Those variable character lengths would make the hardware pretty complicated. We want a fixed-format binary code, then. Most of the character positions are letters, so 5 bits per character should be enough. This immediately suggests Teletype code, but this has problems. The LTRS and FIGS characters required would add to the length of the call without carrying any information. The code itself has no rhyme or reason, and this would create difficulties in the use of a very simple autocall box in which the operator must manually encode the call of the station to be alerted.

In the code proposed here, we make use of the information about the format of a call that is implied by the fact that we are

dealing with a ham call. We know that every call consists of a prefix and a suffix, that the suffix consists of one to three letters, and that the prefix consists of a digit preceded by one or two letters or a digit and a letter. Every character except the first is known in advance to be a letter or number by its position in the call, and hence this need not be sent. All we need is an extra bit to resolve the question about the first character. We take care of the fact that some calls have less than the maximum number of characters by defining a code for space.

In Fig. 1, we begin by assigning 5 bits to each of the 6 characters that make up a call. The first character of the call always gets the first character of the prefix. The last digit of the prefix, which is always a numeric digit, goes to the third character. If there's a letter between the first character and the digit, it goes into the second character of the call; otherwise a space goes there. The suffix begins with the fourth character, and continues until all letters are encoded. The remaining characters are filled with spaces. The King of Jordan uses three spaces, obviously. The third character can only take on ten values, so it can make do with 4 bits. On the other hand, the first character can be either a letter or a number, so it can have 36 values and hence needs 6 bits. So we borrow one. The high-order bit of the third character becomes the FCN, or "first-character-numeric," bit. When it is a 1, it indicates a call that begins with a number.

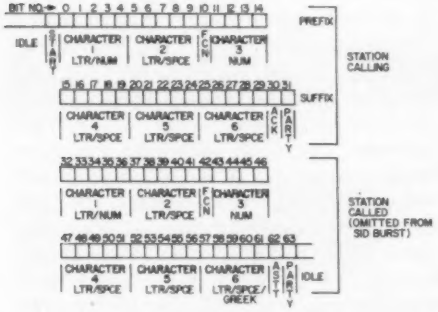

Fig. 1. Proposed autocall and SID word format.

We have assigned 30 bits. Logic hardware likes to work with numbers that fall on powers of 2. The next one would be 2^5 or 32. It's easy to find worthwhile things to do with 2 more bits. We use the last one for a parity bit, to help a receiver identify and reject a call that had one bit altered by noise. This leaves one. Two, really, because there are two calls in the whole transmission. I would assign the one in the identification call to indicate acknowledgement of a previous autocall or autostart transmission. The one in the other call would tell whether the purpose of the transmission is to signal the operator or start equipment to record an incoming message. 1-bits would indicate ack and autostart, respectively. Parity should be odd; that is, a 32-bit group should contain an odd number of 1-bits.

Now let's turn to Table I, which defines the binary code. Basically, the letters are numbered from 1 to 26 and written in binary form. Number 0 is a space. For numbers, the values 0 through 9 are simply written in binary form. Four additional bit configurations are defined for the sixth character of the station called; these are used for things other than a call to a specific station. They are recognized by 1's in the three left-most bits. The first two are for group of symbolic calls, such as alerting nets or obtaining some service that might be provided by any of a number of stations at different times. The other two special codes are for radio control.

I would suggest that alpha calls be assigned to nets and other groups of stations on request, through a trustee or other officer. These should go in the callbook or net directory. Beta calls would be symbolic calls, designating a function and location. It should be possible to assign many of them in a systematic way, such as by state, county, or metropolitan area, and by service provided. Examples: WA6AC-alpha might convene an emergency net in Alameda County, and WP2NY-beta might be a request for a phone patch into New York City. Some group calls would transcend national boundaries; I would suggest using zero in the first and third characters for these. A good example of this would be a worldwide distress call, which might be coded as 0Q0RR-beta.

Table I

BINARY CHARACTER CODES

Character	Char. 1 F C N	Char. 2, 4, 5, 6	Char. 3	Char. 6 of station called
Space		00000		
A	000001	00001		
B	000010	00010		
C	000011	00011		
D	000100	00100		
E	000101	00101		
F	000110	00110		
G	000111	00111		
H	001000	01000		
I	001001	01001		
J	001010	01010		
K	001011	01011		
L	001100	01100		
M	001101	01101		
N	001110	01110		
O	001111	01111		
P	010000	10000		
Q	010001	10001		
R	010010	10010		
S	010011	10011		
T	010100	10100		
U	010101	10101		
V	010110	10110		
W	010111	10111		
X	011000	11000		
Y	011001	11001		
Z	011010	11010		
0	100000		0000	
1	100001		0001	
2	100001		0010	
3	100011		0011	
4	100100		0100	
5	100101		0101	
6	100110		0110	
7	100111		0111	
8	101000		1000	
9	101001		1001	
alpha				11100
beta				11101
gamma				11110
delta				11111

The gamma codes would be used to trigger remote-control functions, where uniqueness of codes is important. Presumably the Commission wouldn't want to be stuck with issuing them, but perhaps the

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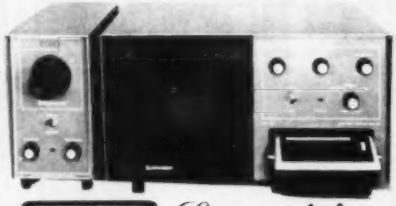

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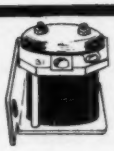
League or some volunteer committee could do that. The delta codes would be for anybody's use, and depend on probability to keep from activating somebody else's black box. Any combination of bits with a delta in the last character is okay, as long as the parity is odd.

This code is a close relative of ASCII, which would be handy in the design of computer-controlled message-handling equipment.

An NRZ keying scheme similar to Teletype should work out well, provided all units have the same clock rate within half a percent or so, which is easy enough. The transmission would begin with a system idling at logic 0 long enough to establish AVC levels and otherwise initialize the receiver. Then it would go to logic-1 for one clock period to start the decoder. The following 64 clock periods would each be assigned to a bit, and contain either logic level. After that, the system would go back to idling condition for at least 2 clock periods, if several stations are being alerted together, or drop out of autocall mode and perhaps go to receive. In an SID burst the transmitter would go back to normal operation after 32 data bits.

I'm not sure how the FCC plans to module the SID pulses to achieve compatability with all transmitters. FSK won't work with most CW and AM rigs, and few FM rigs have any CW capability. Subcarrier methods won't work with CW-only rigs. I suppose CW would be the easiest adaptation, since grid-block keying is a relatively easy modification. A 5-mS SID burst would still present problems with a CW or FSK station, because the fast keying rate would require much more bandwidth than the normal signal. Slowing it down would most likely cause annoying interference to the main signal. A warning light half a second before the SID takeover might help, plus an interlock line to the Teletype tape reader.

Frequencies need a little thought. Any service that operates on a recognized frequency should have its autocall receivers on that frequency, not on the calling channel. A net that uses the autostart feature as a selective squelch should do it on the NCS frequency, at least while the net is in session.



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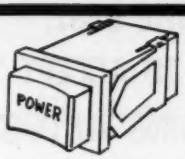

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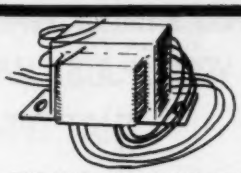

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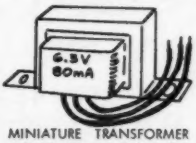

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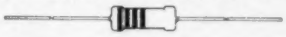

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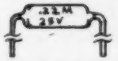

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Operation on the calling frequency should be minimized. In fact, it might be a good idea to set aside a second frequency for establishing contact and agreeing on a working frequency. If the service gets popular, it might even be necessary to set up several contact frequencies, and make the choice between them according to the third character of the station called. (The station called is the only piece of information that will always be known to both stations, even in the case of a primitive autocall decoder.) The use of the autocall frequency for autostart and actual transmission of messages should be reserved for emergencies.

We need one accurate oscillator, to set the keying rate. It would be nice to have that oscillator control everything, so one adjustment does it all. This means that every frequency in the system should be a multiple or submultiple of the master oscilaltor. Similarly, the oscillator should be a multiple or submultiple of WWV. 2.5 MHz is a submultiple of all HF broadcasts, but not every ham band contains a multiple of this frequency. 100 kHz would be better. This is still not a submultiple of the 60 kHz broadcast, but a digital divider could generate 10 kHz, which is. Therefore, I suggest that the autocall frequency in each band be a multiple of 100 kHz, and the keying rate be a submultiple of 10 kHz. The contact frequency should be 10 kHz from the autocall frequency. Naturally the standard could contain a high-frequency crystal oscillator to save space, and divide it down to 100 kHz.

This autocall system can do more things than most people would want. There would be a need for a number of different kinds of units, with varying features and levels of sophistication, from the basic SID box to the NCS's unit that can call any of dozens of stations at the push of a button.

I've deliberately avoided discussing the nitty-gritty of hardware in this brief article. The first priority is to figure out what we want to do, before the FCC hands us something that doesn't fit our needs. The traffic and phone patch people should have some relevant comments, in particular.

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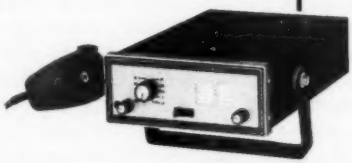

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CHOOSING AND USING AN ELECTRONIC CALCULATOR

Having watched the prices of electronic calculators drop drastically in the last year or two, I finally decided to splurge. It was a tricky decision, since in a falling market you hate to buy something if you suspect that a month later you'll be able to get it for half the price. Still, I finally decided that prices were close to the bottom (which wasn't quite correct) and took the plunge. I've now been using my little gem for almost a year, and hardly a day goes by that I don't use it for something or other (I don't doodle, so sometimes I just sit at my desk and play with the calculator, finding the square root of my phone number. . .).

If you have been thinking of buying one, or already have one and want to know how to use it better, then read on. Here's the real story.

If you still don't have one, then go out and buy one – otherwise this article won't make much sense to you. But first, you'll have to decide just how much of a calculator you want. The most common ones, sold all over the country, have four basic functions – they add, subtract, multiply and divide. That's really all you need, but if you pay more you sometimes get more (not always). The Cadillac of them all is a $400 unit made by Hewlett-Packard, the HP-45. In addition to the four basic functions, this one also finds sines, cosines, tangents, inverse sines, inverse cosines, inverse tangents, both common and natural logarithms as well as antilogs (powers of ten and exponentials), squares, square roots, reciprocals, factorials, percentages, percent differences, sums of squares, mean and standard deviation. But that's not all – it converts from degrees-minutes-seconds to decimal degrees and backwards, it converts from polar coordinates to rectangular coordinates and back, it converts from degrees to radians and back, it converts from inches to centimeters and back, kilograms to pounds and back, liters to gallons and back. It lets you work on two sets of numbers at the same time, it displays pi (3.14159), and probably does a dozen other things as well – all at the touch of a button. It's a battery-operated unit that fits your pocket, and is an engineer's best friend. They call it an Electronic Slide Rule, but it really does much more than that. To extend the ease of use for engineers and scientists, this unit includes circuitry for scientific notation – the use of multipliers (powers of ten) for very large and very small numbers. All in all, a great device.

Another Hewlett-Packard calculator, at the same price, is a business model which finds percentages, interest rates, markups, rounds off to the nearest cent and even finds the number of days between any two dates.

If you think $400 is too much, then a drop to $300 gets you either the HP-35, which does about half as much as the HP-45 (that's still a lot, though) or an MITS desk-top unit that's roughly comparable.

For engineering calculations, the Hewlett-Packard and MITS units are the

only widely advertised units that have all of the trigonometric, exponential and hyperbolic functions you might need for really serious calculations. But there's no reason to spend that much if you are a non-professional – for amateur and household use the only functions that you will use fairly often (besides the basic add, multiply, subtract, and divide) are the reciprocal and square root. If you want to spend about $100, you can get a Texas Instruments or MITS unit that is also small enough for a pocket, and which does reciprocals and square roots. But even that's a lot of money.

That finally brings us down to the common type of calculator, the one that most hams can afford. So let's talk about that.

First, they come in various sizes. The table-top models, being line-powered, can afford to use big, bright readouts and big keys. The pocket models (you sometimes need big pockets) are perhaps $10 to $30 more expensive, and use tiny readouts that may be hard to see, especially in a bright light. Some come with rechargeable batteries and (usually) external chargers. But watch out – the very cheap battery models often use non-rechargeable batteries which don't last very long. They may seem cheap to start with, but you may go broke buying batteries.

Talking about readouts, most table-top units use ½" or larger displays, such as the Sperry or Burroughs neon readouts; most pocket units use ¼" LED (light-emitting-diode) readouts. One portable unit (the Lloyd, also available under other names) uses a liquid crystal readout. Aside from the fact that this type of display has (at this time) a limited life, the Lloyd calculator is very large and uses non-rechargeable D cells. The liquid crystal display is also hard to see. When and if liquid crystals become cheap and good, they will really cause a revolution in calculator design, since they take very little power, and even dry cells will last a long time.

The next thing to consider when choosing a calculator is whether it has a fixed or floating decimal point. In a fixed-point calculator, the position of the decimal point is either fixed in the design, or else set by a small switch at one of several places. In a floating-point calculator, the decimal point will automatically be placed by the machine in the best place, depending on the number. Basically, the fixed-point models are good for dollars and cents, and the floating-point models are good for everything else.

Using a fixed-point calculator for dollars and cents is handy, because you can always select exactly two decimal places in all of your numbers, and also because most of these models will round off to the nearest cent. For instance, if you figure out the sales tax, say 6% on $1.63, a floating-point calculator will give you an exact value of $0.0978, while a fixed-point machine will round that off to $.010. This is good for money, but not if you are going to calculate capacitor values.

The most useful choice is then a machine which allows you to select either fixed or floating mode (and many, such as the $80 Heathkit, give you that choice); but if you have to go one way or the other, then the floating-point is the better choice.

Just to show you how bad the fixed-point is, suppose you want to find reactance of a 10 μF capacitor at 60 cycles. Using the formula

$$XC = \frac{1}{2\pi f C}$$

You practically have to stand on your head to do this on a fixed–point machine because 10 μF is actually 0.00001 farad (remember, the formula holds for farads,) and most fixed–point machines won't let you enter that 0.00001 as a number – they simply round it off to something like 0.00!

On the other hand, if you use a floating-point calculator, you just take 1, divide it by 2, divide that by π (3.14159265), divide that by 60, and finally divide that by 0.00001, to get 265.25 Ohms. And if you do it slightly

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differently, you can get an even more precise answer of 265.25823 Ohms, though it probably won't do you much good.

Another feature to look at is the number of digits you get. Most inexpensive calculators have eight digits plus one more for either a minus sign or an error indication. You can save a little money by getting only 6 or even 4 digits, but at a tremendous loss of convenience. A small number of digits is really not enough for serious calculating. The manufacturers know this, and usually include circuitry for doing calculations on longer numbers, and then displaying just part of the number at a time. For instance, what may be the cheapest machine yet is a small Sharp unit that sells for $38 in Japan. It offers 12-digit calculations – fixed point, with nine digits before the decimal point and three after – but only three digit display. To see the whole 12 digits, you have to hit a special key that lets you see three digits at a time. As far as we're concerned the dollar saving isn't worth the effort.

But some units advertise "8-digit display, 16-digit capacity." This doesn't usually mean what it sounds like. You probably think it means that you can use numbers up to 16-digits longer, but that's not so. You can still only use 8-digit numbers, but you can get 16-digit long answers though only accurate to the left-most 8 places. An example will display what we mean.

Suppose you want to multiply 12345678 times 599, which has a correct answer of 7395061122, but using an 8-digit machine. The answer is 10 digits long, so what happens? Some machines just stop and don't even try it. Others will do it, but only display the left-most 8 digits of the answer. (A very few will let you press another key to see the right-most digits.) But a "16-digit capacity" model will display the answer as 73.950611E; if you know how to read it you're ahead. First of all, the E means error – you've done something you shouldn't have. The digits 73950611 are the first 8 digits of the correct answer. And finally, the decimal point tells you how big the answer is – the instruction manual says to move the decimal point 8 places to the right – adding a few zeroes if needed – and you get the answer as about 7395061100. And that's at least close.

A worthwhile feature is a constant key. Essentially, this key lets you enter a given number (called the constant) into the calculator for use over and over in succeeding calculations. In most calculators, this constant can only be used in multiplication or division, though in some it can also be used to add and subtract. This feature is of great help, for instance, in calculating crystal frequencies if you're an FM fiend.

Suppose you have a pile of 18 MHz crystals, and you want to see what 2m frequencies they will transmit on. Since the multiplication factor here is 8, you push down the K (constant) key, and key in the number 8 x, which sets up the constant function for a multiplication by 8. To find the frequency of an 18 MHz rock, just enter 18 =, and you get the answer 144 MHz. To find the transmit frequency of an 18.3675 MHz rock, just key in 18.3675 =, and the answer pops up as 146.94. Notice that you don't have to reenter the 8 x again.

In division, you can use a constant divisor. For example, you have to order a few transmit crystals for a 450 MHz transmitter that uses a crystal multiplication factor of 36. To get the crystal frequencies, first push down the K key, and enter 448.55 ÷ 36 = and the answer comes up 12.459722 (we sure hope you have a floating-point machine, since a fixed-point calculator will come up with 12.46 which is about as useful as doing it in your head). For the next crystal just enter 445.05 = and the answer appears as 12.3625. For more crystals just keep going in the same way.

You can do a whole series of divisions, using the *same divisor*, very fast. But notice that this scheme doesn't really help you very much if you have to order receive crystals, since you can't use the constant feature if you first have to subtract the i-f frequency and then divide. Although everyone ballyhoos the constant feature in their ads, it isn't really that useful in most calculations.

But the constant feature is useful in doing a trick which sometimes is very handy. If you remember a few paragraphs back we mentioned that reciprocals and square roots are important. Well, many units that have a

constant allow you to get reciprocals by pushing a certain sequency of keys. This, and a related trick for squaring, are not advertised and don't work on all cheap calculators. But if it works on your unit, then more power to you – you are about to save yourself a lot of work.

First the trick for squaring. Suppose you want to square a number like 9. Normally you'd have to push 3 x 3 =; that is, multiply the 3 by itself, which would then give you the answer of 9. Notice how you have to enter the 3 twice. But on some calculators, when you push the first 3 x, the 3 goes into an internal operations register, and *also still stays on the display*. Keying in the second 3 is then really a waste, and if you go directly to the = key, you will get the square, 9. It doesn't really make much difference with 3, but suppose you want to square something like 3.1622777 – it makes a big difference whether you have to enter the number once or twice. The trick now – and remember, it will not work on all calculators – is to just key in 3.1622777 x = and you get the square. This is a worthwhile trick to try in the store before you buy your unit, since if you use your calculator for electronic calculations you will often have to find square roots – and the best way of checking the square root is to square it, right? The reason they don't advertise it is that it is really a byproduct of the design – not something purposely designed into the calculator.

And now to the reciprocal. Suppose you want to find the reciprocal of a number that's on the display – you may have just calculated it, and now want to find the reciprocal. The obvious way is to write it down, and then key a 1 and divide by the number you have written down. But note that this requires an extra step – you have to write down the intermediate answer. (By the way, this is where a calculator with memory may be of some advantage, but you don't need it.) The trick for finding a reciprocal without actually doing the division into one is similar to the squaring trick. First, starting with the number whose reciprocal you want to get on the display, push down the K key and then hit ÷ =. Just as hitting x = in the squaring trick multiplied a number by itself, so hitting ÷ = divides the number by itself, and so you get a display of 1. But since you're set to constant, doing this also sets the calculator for a constant division by the original number. If you now turn off the constant feature by releasing the K key and then hit the = key one more time, you actually do that one last division and get 1 divided by the original number – the reciprocal.

Now, why is the reciprocal so useful? Let's show you with an example. Suppose you want to find the equivalent resistance of two resistors in parallel, one of them 12K and the other 68K. The well-known formula is the "product over the sum,"

$$\text{Equivalent R} = \frac{12\text{K} \times 68\text{K}}{12\text{K} + 68\text{K}}$$

The problem is that you first have to add up the two resistors on the bottom, save that answer, then multiply out the two resistors on the top and divide by the sum you've saved. If you have a calculator with memory it's easy to save that intermediate answer, but otherwise you have to do it separately and write it down (though in this case it's easy to remember, 80K). But with the reciprocal you do the problem backwards:

$$\frac{12\text{K} \times 68\text{K}}{12\text{K} + 68\text{K}} = \frac{1}{12\text{K} + 68\text{K}} \times 12\text{K} \times 68\text{K}$$

See, you break up the problem like this: First add 12K to 68K to get 80K. Then find its reciprocal (0.0000125) and right away multiply it by 12K and by 68K.

Well, now that we've covered the most important features of the common garden-variety of calculator and some of the tricks we can do on some of them (hint – if you haven't bought a calculator yet, take this article with you when you go and try out the squaring trick and reciprocal trick in the store to make sure you get one that works) let's look into more tricks for making our calculations easier. Let's go back to the parallel resistor problem,

$$\frac{12\text{K} \times 68\text{K}}{12\text{K} + 68\text{K}}$$

and let's do it the long way. 12K + 68K on the bottom is 80K, so we'll write it down.

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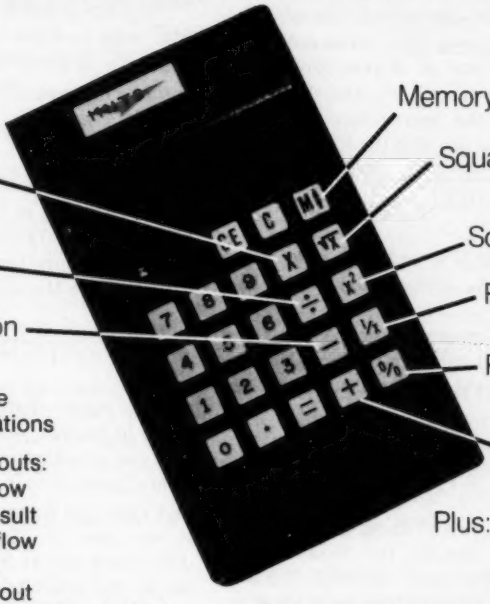

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Now let's multiply 12K x 68K. Oh, your calculator doesn't have a KΩ key? Well, of course K means 1000, so 12K becomes 12000 and 68K becomes 68000 when you key in the numbers. Good, here we go.

12000 x 68000 = 8.1600000E

Hmmmm! The product happens to be over 8 digits long, and so we got that funny readout. Now what? A good thing to remember is that our formula will work for Ohms, kilohms, megohms, even milliohms. Just make sure that all of your resistors are expressed in the same units, and the answer comes out in the same units. What this means is that we can skip the K and do this:

$$\frac{12 \times 68}{12 + 68} = 10.2$$

omitting all the K's, and this gives us an answer also in K. Hence the answer is 10.2 KΩ.

As another example, suppose you put 100 K in parallel with 1 MΩ. Since 100 K is .1 MΩ, you could do the calculation like this:

$$\frac{.1 \times 1}{.1 + 1} = \frac{.1}{1.1} = 0.090909\ M\Omega$$
$$= 90.909K\Omega$$

Still another way of doing the problem is to note that, though the formula says "product over the sum," we don't have to do it just in that order. We could break up the original problem like this:

$$\frac{12K \times 68K}{12K + 68K} = \frac{12K}{12K + 68K} \times 68K = \frac{12K}{80K} \times 68K$$

Doing it in this order keeps the numbers from getting too big. 12K divided by 80K (which you can do either by doing 12000÷80000 or as 12÷80) gives 0.15, and then multiply it by 68000 gives 10200 Ohms.

Another useful trick is to remember that:

kilo x milli = 1

mega x micro = 1

These are obvious when you realize that, for instance, kilo means 1000 and milli means 0.001; multiply them out and you get 1.

For instance, you want the RC time constant of a 0.001 microfarad capacitor with a 100 K resistor. The textbook says that the RC formula has to have R in Ohms and C in farads, but 0.001 microfarads is 0.000000001 farads, and that's over 8 digits long so you can't enter it. But since mega x micro = 1, convert the 100 K resistor to 0.1 megohm, and use the 0.001 microfarad as is:

0.1 MΩ x 0.001 μF = 0.001 second

Another example will bring it out better. You want to know the reactance of a 47 pF capacitor at 6.125 MHz. Well, the standard formula for capacitive reactance is,

$$XC = \frac{1}{2\pi f C}$$

where f is supposed to be in Hertz and C is supposed to be in farads. Great – what do you do with a 0.000000000047 farad capacitor if you only have an 8-digit calculator? Simple – use Megahertz and microfarads:

$$XC = \frac{1}{2 \times 3.1415926 \times 6.125 \times 0.000047}$$

(this is where that $400 calculator would come in useful – just enter it as 47×10^{-12} and you've gotten out of it!) Now you could either multiply out the whole denominator and then find its reciprocal, or an easier way is to take 1, divide by 2, divide by 3.1415926, divide by the 6.125, and finally divide the result by 0.000047, which gives you the answer of 552.85957 Ω.

And now on to the real good stuff – what about square roots? You say you don't need them? Well, what do you do when you want to find the resonant frequency of an LC circuit from the formula:

$$f = \frac{1}{2\pi\sqrt{LC}}$$

How do you find $\sqrt{LC}$? Or you want the voltage across a 50Ω resistor when the power in it is 1 watt – the equation for power is:

$$P = E^2 / R$$

So, $E = \sqrt{PR}$. There must be dozens of electrical equations which require square

roots. You could of course plunk down $$$ for an expensive calculator doing them, but it turns out that a simple procedure can find the square roots even on a simple calculator. To see how it's done, let's try a real simple example – finding the square root of 16.

Not having a square root calculator, we could start out by trying a few guesses. Suppose we try a guess of 3, and check it by squaring 3 x 3 = 9. Nope, 3 was too small a guess. Try 3.5, then 3.5 x 3.5 = 12.25. Nope, still too small, but getting closer, right? Well, we could try 3.8, maybe?

At this rate you might go on a long time before you get there. But suppose we told you that it wasn't such a harebrained scheme – that there was a valid mathematical method that does just this, and that its secret is the presence of a formula that tells you what guesses to try? It's usually buried in obscure textbooks on numerical methods under the name, *Newton-Raphson Iteration*, and it goes like this:

First, take a guess at the square root. Try to take a good guess, but don't worry if you're pretty far off. For the sake of this discussion, we're going to use 3 as a guess for the square root of 16.

Take the 3 and divide it into the 16 on your calculator:

$$\frac{16}{3} = 5.3333333$$

Now look at what you did. Suppose you had taken the right guess (4) and divided it into 16 – the answer would have then been 4, right? A number, divided by its square root is always equal to the square root (16 ÷ 4 = 4, 25 ÷ 5 = 5, and so on).

But, of course, we weren't that lucky, since we had a bad guess. Our guess will usually be either too small or too large. In this case 3 was too small a guess. So what happens when we do the division? *The answer comes out too large!* Here 3 is smaller than the real square root, while 5.3333333 is too large. (Had our guess been too *large*, then the quotient would have been too *small*.) Either way, the actual square root is somewhere *between* the guess we take and the quotient we get when we divide that guess into that number. Well, as the next guess, why not try the *average* of these two? We do this by adding the guess to the quotient and then dividing by 2, like this:

$$\text{2nd guess} = \frac{\frac{\text{Number}}{\text{1st guess}} + \text{1st guess}}{2}$$

$$\text{3rd guess} = \frac{\frac{\text{Number}}{\text{2nd guess}} + \text{2nd guess}}{2}$$

$$\text{4th guess} = \frac{\frac{\text{Number}}{\text{3rd guess}} + \text{3rd guess}}{2}$$

It turns out that, no matter how bad our first guess is, the second is always more accurate, the third is even better, and so on. If the original guess is pretty close, then as few as two or three repetitions of this formula will give you the right answer within the accuracy of your calculator. Usually, out of the first 8 digits on the calculator, the first 7 will be correct and the last one may be slightly off, but even this is within something like 0.0001%, and that's close enough.

For instance, let's complete our example above: 16 divided by 3 is 5.3333333, so:

$$\frac{\frac{16}{3} + 3}{2} = \frac{5.3333333 + 3}{2} = \frac{8.3333333}{2} = 4.166666$$

Notice that this is a lot closer to 4 than the original guess was. Repeat it again:

$$\frac{\frac{16}{4.1666666} + 4.1666666}{2} = 4.0033333$$

and again:

$$\frac{\frac{16}{4.0033333} + 4.0033333}{2} = 4.0000013$$

and again:

$$\frac{\frac{16}{4.0000013} + 4.0000013}{2} = 4.0000000$$

And there you are – the right answer after four repetitions. Actually, the entire repetition of the formula can be done in a few seconds, so it is quite an easy process when you get the hang of it. How do you know when to stop? Simple – when the numbers start to repeat themselves.

Just to show you how easy it is, let's try it again, this time to find the square root of 10. Try 3.2 as the first guess:

$$\frac{\frac{10}{3.2} + 3.2}{2} = 3.1625$$

$$\frac{\frac{10}{3.1625} + 3.1625}{2} = 3.1622776$$

$$\frac{\frac{10}{3.1622776} + 3.1622776}{2} = 3.1622776$$

You are starting to repeat yourself, so it's time to stop. The actual square root is a bit closer to 3.1622777, but we are as close as we can get on an 8-digit calculator.

In this case it took us only three tries to get the answer – in general, the closer your first guess, the faster you'll get to the answer. But if your first guess is real bad, it doesn't mean that your answer will be any less accurate – it only takes a little longer to get it.

On very large or very small numbers it may be a little hard to get a good first guess. The trick here is to break up the number into groups of two digits, starting from the decimal point, and have one digit in the guess for each group of two digits in the original number.

For instance, for the square root of 16,777,216, break it up into groups of two digits like 16 77 72 16. Since there are four groups of two digits, the guess should have four digits in it. But even better, since the square root of the first group (16) is about 4, make the first digit of the guess a 4. Hence, a good guess would be 4000 or a little more (the actual square root of 16,777216 is 4096).

As another example, for the square root of 0.00000007, break it up as 0. 00 00 00 07 and, since the square root of 07 is somewhere around 3, use 0.0003 as a guess.

This last example shows another problem – 0.00000007 is too long for an 8-digit calculator. The best way to find its square root is to break it up into two parts, perhaps something like:

$$0.00000007 = 0.07 \times 0.000001$$

Find the square root of each part separately, and then multiply out the square roots. The square root of 0.07 here is .2645751, while the square root of 0.000001 is 0.001; multiply the two out and you get 0.0002645751 as the square root. Finding the square root of 0.000001 is really easy if you know scientific notation, since 0.000001 is 10^{-6}, and the square root of that is automatically found to be 10^{-3} but that's another subject.

As our last set of tricks, we will describe some formulas you can use if you want to find things like sines, cosines, tangents and exponentials (powers of e). You could, of course, look these up in a table, or else get the $300 or $400 calculator, but if you use the following formulas you will get answers almost as accurate. Obviously, if you don't know what these are, then you probably don't need them. But if you do, they might be handy. By the way, if you would like to look up the derivations of these, they may be found in most textbooks on numerical methods (such as reference 1) under Maclaurin series, using Horner's rule, with angles converted from radians to degrees. So here goes: for the sine and cosine, with an angle X in degrees (only angles between 0° and 90° will work accurately; for other angles you will have to convert to an angle between 0° and 90°), use the following formulas:

$$\sin X = \frac{X}{57.295779}\left\{1 - \frac{X^2}{19696.837}\left[1 - \frac{X^2}{65656.124}\left(1 - \frac{X^2}{137877.86}\right)\right]\right\}$$

CALCULATING THE SINE OF 30 DEGREES

DO THIS (STARTING FROM THE TOP)	BY PUSHING	AND DISPLAY SHOWS
Clear the machine	C	0.
Enter 30 degrees	30	30.
square it	x=	900.
and divide it	÷	900.
by 137877.86	137877.86	137877.86
and make it negative	=–	–0.0065275
Now add 1	1+	0.9934725
Multiply by 30	x	0.9934725
Multiply by 30	30	30.
and again by 30	x	29.804175
and again by 30	30	30.
and divide it	÷	894.12525
by 65656.124	65656.124	65656.124
and make it negative	=–	–0.0136183
Now add 1	1+	0.9863817
Multiply by 30	x	0.9863817
Multiply by 30	30	30.
and again by 30	x	29.591451
and again by 30	30	30.
and divide it	÷	887.74353
by 19696.837	19696.837	19696.837
and make it negative	=–	–0.0450703
Now add 1	1+	0.9549297
Multiply by 30	x	0.9549297
Multiply by 30	30	30.
and divide it	÷	28.647891
by 57.295779	57.295779	57.295779
and get the final answer by pushing =		0.5

$$\cos X = 1 - \frac{X^2}{6565.6124}\left[1 - \frac{X^2}{39393.672}\left(1 - \frac{X^2}{98484.18}\right)\right]$$

CALCULATING THE COSINE OF 60 DEGREES

DO THIS (STARTING FROM THE TOP)	BY PUSHING	AND DISPLAY SHOWS
Clear the machine	C	0.
Enter 60 degrees	60	60.
square it	x=	3600.
and divide it	÷	3600.
by 98484.18	98484.18	98484.18
and make it negative	=–	–0.036554
Now add 1	1+	0.963446
Multiply by 60	x	0.963446
multiply by 60	60	60.
and again by 60	x	57.80676
and again by 60	60	60.
and divide it	÷	3468.4056
by 39393.672	39393.672	39393.672
and make it negative	=–	–0.0880447
Now add 1	1+	0.9119553
multiply by 60	x	0.9119553
multiply by 60	60	60.
and again by 60	x	54.717318
and again by 60	60	60.
and divide it	÷	3283.039
by 6565.6124	6565.6124	6565.6124
and make it negative	=–	–0.5000354
and finally add 1	1+	0.4999646

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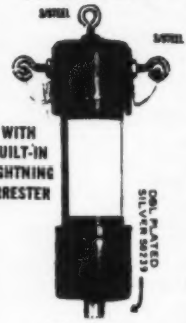

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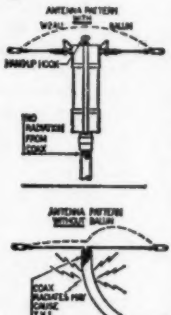

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Both of these formulas can be done in one long series of calculations without writing down any intermediate answers, but starting from the right and working to the left. For example: To get the sine of 30° (the exact answer is .5000000), or to get the cosine of 60° (also an exact answer of .5000000) we proceed as in the Table. Each of these formulas is very accurate for small angles, and becomes slightly worse at large angles. To find the tangent of an angle, find both the sine and the cosine and then divide the sine by the cosine.

To find the values of of e^x (exponentials) for values of x less than 1, and with an accuracy of about 0.1%, use the following formula:

$$e^x = 1 + X\left\{1 + \frac{X}{2}\left[1 + \frac{X}{3}\left[1 + \frac{X}{4}\left(1 + \frac{X}{5}\left(1 + \frac{X}{6}\right)\right)\right]\right]\right\}$$

As before, we start from the right and go toward the left, in the sequence: Take X, divide by 6, add 1, multiply by X, divide by 5, add 1, etc. As before, we get better accuracy when X is quite a lot less than 1. In case you want to try your luck on your calculator, the value of e (calculated from the above formula by letting X equal 1) is supposed to be 2.7180555; not bad.

Conclusion

If we haven't confused you completely by now, then consider yourself lucky. The moral of the story is that even an expensive calculator won't do your thinking for you, but if you know how to juggle numbers then it can really make your life easier. Hopefully, the above information will help you make a little better use out of your unit and you will soon find, as we have, that these little critters are more fun than a barrel of monkeys. If, on some rainy afternoon, you have nothing better to do, why don't you try to find the square root of *your* telephone number?

...K2OAW

REFERENCE:
(1) Introduction to Numerical Methods by Peter A. Stark, MacMillian Co., 1970. Make the author real happy by going right out and buying a couple of copies!

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OPTIMUM CW FILTER DESIGN

There have been dozens of papers written on designn and construction of CW audio filters. This type of filter can allow a marginal receiver to perform acceptably and a fine receiver can be further improved. Today's crowded bands makes a selective receiver system mandatory. The published articles vary from passive filters to complex active filters, with center frequencies from 200 Hz to 1020 Hz, and with bandwidths from 30 Hz to 600 Hz. The object of this article is to present sufficient design criteria and experimental data to allow the perspective builder of a CW audio filter to guide his design towards a filter that is optimum for his particular operating needs. This is not a construction article and the design criteria apply equally well to passive and active filters.

Fig. 1 shows a normalized plot of a bandpass filter, typical of the type used in CW filters. The bandwidth, or selectivity, for this type of filter is usually specified at the –6 dB point. From the curves of Fig. 1, it can be seen that the normalized bandwidth is determined by the Q of the filter. This relationship is:

$$Q = {}^{f_o}/_{\Delta f} = \frac{\text{Resonance Frequency}}{\text{-6 dB Bandwidth}}$$

Since amateur operators are primarily interested in an absolute filter bandwidth in

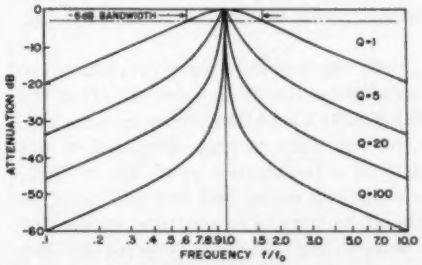
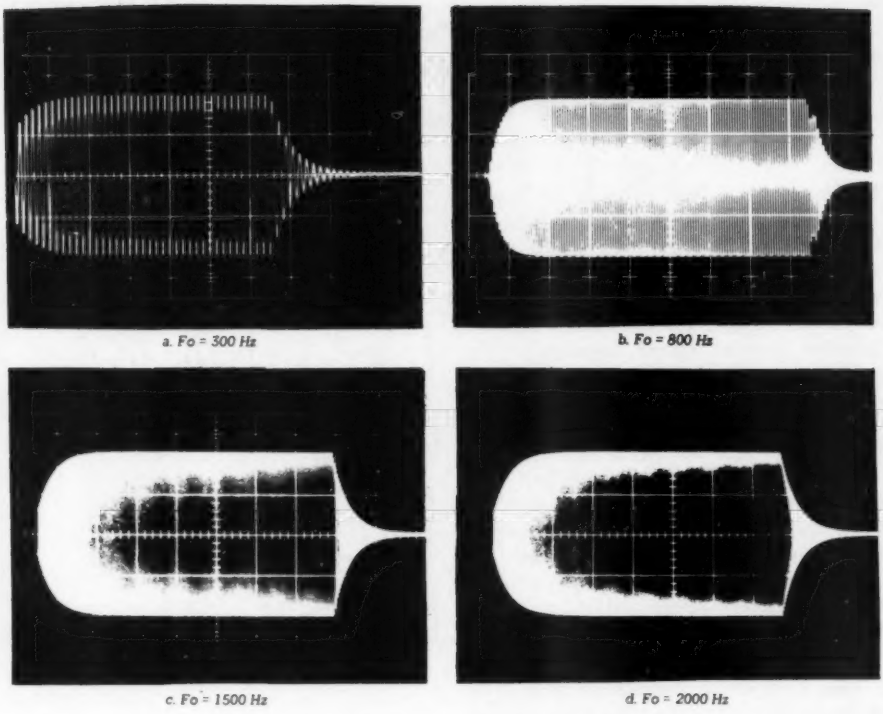


Fig. 1. Band-pass transfer characteristics normalized for unity gain and frequency.



a. Fo = 300 Hz

b. Fo = 800 Hz

c. Fo = 1500 Hz

d. Fo = 2000 Hz

Fig. 2. Keyed waveform of CW filters with 50Hz bandwidth and center frequencies of 300, 800, 1500 and 2000 Hz. (Horiz. = 20 msec/cm).

Hz rather than a normalized bandwidth, it's apparent that, for a fixed Q, the absolute bandwidth will decrease in direct proportion to the resonant frequency of the filter.

An experimental investigation was made to determine the effects, if any, of variations of center frequency while maintaining a constant filter bandwidth of 50 Hz. This data is shown in Fig. 2a, b, c, d. These figures show the shape of a keyed waveform after passing through the filter. It's interesting to note that the rise and fall times (rise time is the time required for the filtered waveform to go from 10% to 90% of its full value) of the waveform are the same, regardless of the center frequency. This indicates that for a fixed filter bandwidth, the performance is independent of center frequency, even though the Q of the filter ranged from 4 at 200 Hz to 20 at 1,000 Hz.

Lubkin(2)has shown that the rise time, or fall time of a filter, subjected to a pulse input is approximately:

$$\text{Rise Time} = \Delta t = \frac{.342 \text{ to } .570}{1/2 \times (-6 \text{ dB Bandwidth})}$$

For the data of Fig. 2, this equation predicts a rise time from 13.7 to 22.8 millisecs, which is close to that shown in Fig. 2.

Since rise time is intimately realted to the bandwidth of the filter, it can slso effect the intelligibility of the transmitted information. If the rise time is long compared to the length of a transmitted pulse, dot or dash, the signal will sound distorted and could be difficult to copy. The rise time should not be longer than the time required for the shortest pulse; an acceptable criteria is a rise time equal to 1/2 the length of the shortest pulse.

The Morse Code, being a series of dots, dashes and spaces, looks much like a square wave. This square wave can be represented by the sum of a series of sine waves; a Fourier series. This Fourier series will contain the odd harmonics of the fundamental frequency. Including the first through the seventh harmonic in this series gives a good representation of a square shaped wave. For Morse Code, represented by a Fourier series with the seventh harmonic and the 2 samples per cycle required by Shannon's criteria, the lowest audio frequency that can be used to receive code is 14 times the frequency corresponding to the dot period. The frequency of the Morse Code square wave is a function of the code speed with the dot period determining the frequency (the space between dots is equal to a dot, dashes are 3 dots, spaces between letters, 2 dots, etc.). The CW signal is received as an interupted audio frequency sine wave, with the square wave code pattern being the amplitude envelope of this sine wave.

This representation of a square wave by a sine wave is essentially a sampling technique and Shannon's Law states that it takes a minimum of 2 samples per cycle of the highest frequency persent to convey enough information to be able to reconstruct the original wave form.

The average letter of the alphabet, numbers, and punctuation, has an equivalent length of 11.3 dot periods (2 dot periods make one square wave cycle). For average 5 letter words the frequency of the dot period is a function of code speed.

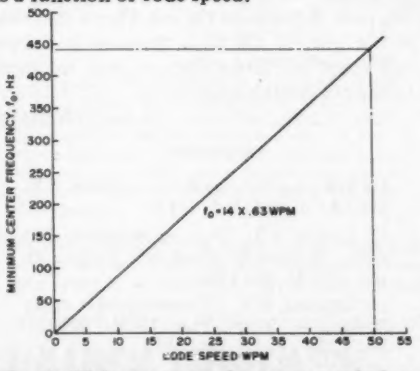


Fig. 3. Minimum center frequency required to accurately reproduce a keyed waveform; Morse Code wpm.

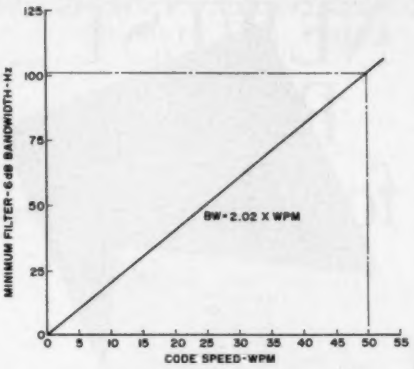


Fig. 4. Minimum allowable -6dB filter bandwidth to acceptably pass a keyed waveform vs. code speed.

Dot Frequency = f_d

$$= \frac{\Delta wpm}{60} \quad \underset{\text{Letters}}{\frac{5\,(11.3)}{2}} + \underset{\substack{\text{Space}\\\text{Between}\\\text{Letters}}}{\frac{12}{2}} + \underset{\substack{\text{Space}\\\text{Between}\\\text{Words}}}{\frac{7}{2}}$$

$$f_d = \frac{wpm\,(37.5)}{60} = .63 \text{ wpm}$$

For 25 WPM, f_d = 15.8 Hz, therefore the minimum frequency required to reconstruct a Morse Code wave form is:

$f_o = 14 \times f_d$ or 221 Hz for 25 wpm

This equation is plotted as minimum center frequency vs. Code speed in Fig. 3.

Now that we have an expression for the frequency of the Morse Code as a function of code speed, we can now relate the rise time and filter bandwidth to code speed. The criteria suggested is to set the rise time to be less than 1/2 of the dot time.

Dot Frequency = f_d = .63 x wpm

$$\text{Dot Period} = 2\frac{1}{f_d} = \frac{1}{1.26} \text{ x wpm}$$

$$\text{Max Rise Time} = \frac{.40}{1/2 \text{ x } (-6\text{db B.W.})}$$

$$\text{Rise Time} = \frac{.40}{(-6\text{db Bandwidth}) \text{ x } 1/2}$$

$$= \frac{1}{2}\,(\text{dot period}) = \frac{1}{2} \text{ x } \frac{1}{1.26} \text{ x wpm}$$

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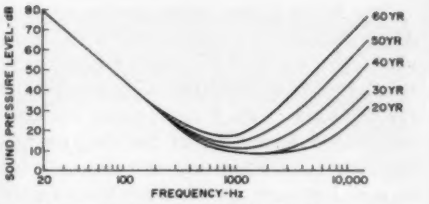

Fig. 5. Threshold of audibility of the ear as a function of frequency and age of listener.

Minimum BW = 2.02 x WPM which is a bandwidth of 20 Hz at 10 WPM and 50 Hz at 25 WPM. This data is plotted in Fig. 4.

Beranek 4 has shown that the human ear acts as a bandpass filter to incoming sounds (see Fig. 5). Since this natural filter must be inserted after an audio filter,, the net filter response will be the result of these two filters in a series. To obtain the best overall filter response one should choose a center frequency for the CW audio filter that corresponds to peak sensitivity of the ear, i.e., approximately 700 Hz for a middle aged ham.

Summary

It has been shown, for a CW audio filter, that there is a minimum center frequency and bandwidth required to pass a keyed waveform that is representative of the input Morse Code and that these minimum values increase with increasing code speed. It was also shown, for fixed Q components, that a low center frequency will yield a narrow bandwidth filter. The optimum center frequency was determined by matching it to the peak response of the ear. I hope that this article will aid CW filter designers to design and construct filters that are well matched to their operating needs.

. . .W6AGX

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(3) Shannon, C.E., "Communication in the Presence of Noise", Proc. I.R.E., Vol. 37, No. 1, Pp 10–21, Jan. 1949

(4) Beranek, L.L. "Acoustics", McGraw Hill New York, 1954

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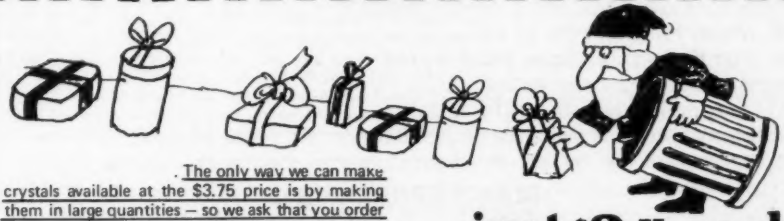

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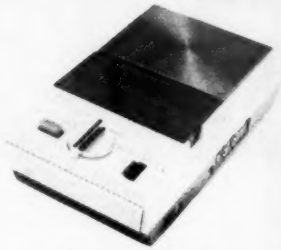

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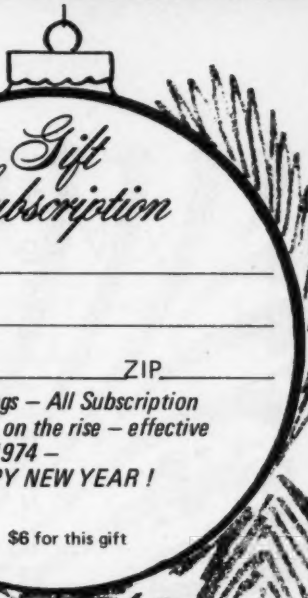
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FCC RULES AND REGULATIONS, PART 97 (VII)

Continuing from last month the complete text of the FCC Rules and Regulations pertaining to the Amateur Radio Service.

Subpart E—Prohibited Practices and Administrative Sanctions

PROHIBITED TRANSMISSIONS AND PRACTICES

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SUBPART E—PROHIBITED PRACTICES AND ADMINISTRATIVE SANCTIONS

PROHIBITED TRANSMISSIONS AND PRACTICES

§ 97.112 No remuneration for use of station.

An amateur station shall not be used to transmit or receive messages for hire, nor for communication for material compensation, direct or indirect, paid or promised.

[*Former § 97.111 redes. as § 97.112 eff. 10-17-72; VI (72)-1*]

§ 97.113 Broadcasting prohibited.

Subject to the provisions of § 97.91, an amateur station shall not be used to engage in any form of broadcasting, that is, the dissemination of radio communications intended to be received by the public directly or by the intermediary of relay stations, nor for the retransmission by automatic means of programs or signals emanating from any class of station other than amateur. The foregoing provisions shall not be construed to prohibit amateur operators from giving their consent to the rebroadcast by broadcast stations of the transmissions of their amateur stations, provided, that the transmissions of the amateur stations shall not contain any direct or indirect reference to the rebroadcast.

§ 97.114 Third party traffic.

The transmission or delivery of the following amateur radiocommunication is prohibited:

(a) International third party traffic except with countries which have assented thereto;

(b) Third party traffic involving material compensation, either tangible or intangible, direct or indirect, to a third party, a station licensee, a control operator, or any other person.

(c) Except for an emergency communication as defined in this part, third party traffic consisting of business communications on behalf of any party. For the purpose of this section business communication shall mean any transmission or communication the purpose of which is to facilitate the regular business or commercial affairs of any party.

[*§ 97.114 added eff. 12-1-72; VI (72)-1*]

§ 97.115 Music prohibited.

The transmission of music by an amateur station is forbidden.

§ 97.116 Amateur radiocommunication for unlawful purposes prohibited.

The transmission of radiocommunication or messages by an amateur radio station for any purpose, or in connection with any activity, which is contrary to Federal, State, or local law is prohibited.

[*§ 97.116 added eff. 12-1-72; VI (72)-1*]

§ 97.117 Codes and ciphers prohibited.

The transmission by radio of messages in codes or ciphers in domestic and international communications to or between amateur stations is prohibited. All com-

munications regardless of type of emission employed shall be in plain language except that generally recognized abbreviations established by regulation or custom and usage are permissible as are any other abbreviations or signals where the intent is not to obscure the meaning but only to facilitate communications.

§ 97.119 Obscenity, indecency, profanity.

No licensed radio operator or other person shall transmit communications containing obscene, indecent, or profane words, language, or meaning.

§ 97.121 False signals.

No licensed radio operator shall transmit false or deceptive signals or communications by radio, or any call letter or signal which has not been assigned by proper authority to the radio station he is operating.

§ 97.123 Unidentified communications.

No licensed radio operator shall transmit unidentified radio communications or signals.

§ 97.125 Interference.

No licensed radio operator shall willfully or maliciously interfere with or cause interference to any radio communication or signal.

§ 97.127 Damage to apparatus.

No licensed radio operator shall willfully damage, or cause or permit to be damaged, any radio apparatus or installation in any licensed radio station.

§ 97.129 Fraudulent licenses.

No licensed radio operator or other person shall obtain or attempt to obtain, or assist another to obtain or attempt to obtain, an operator license by fraudulent means.

ADMINISTRATIVE SANCTIONS

§ 97.131 Restricted operation.

(a) If the operation of an amateur station causes general interference to the reception of transmissions from stations operating in the domestic broadcast service when receivers of good engineering design including adequate selectivity characteristics are used to receive such transmissions and this fact is made known to the amateur station licensee, the amateur station shall not be operated during the hours from 8 p.m. to 10:30 p.m., local time, and on Sunday for the additional period from 10:30 a.m. until 1 p.m., local time, upon the frequency or frequencies used when the interference is created.

(b) In general, such steps as may be necessary to minimize interference to stations operating in other services may be required after investigation by the Commission.

§ 97.133 Second notice of same violation.

In every case where an amateur station licensee is cited within a period of 12 consecutive months for the second violation of the provisions of §§ 97.61, 97.63, 97.65, 97.71, or 97.73, the station licensee, if directed to do so by the Commission, shall not operate the station and shall not permit it to be operated from 6 p.m. to 10:30 p.m., local time, until written notice has been received authorizing the resumption of full-time operation. This notice will not be issued until the licensee has reported on the results of tests which he has conducted with at least two other amateur stations at hours other than 6 p.m. to 10:30 p.m., local time. Such tests are to be made for the specific purpose of aiding the licensee in determining whether the emissions of the station are in accordance with the Commission's rules. The licensee shall report to the Commission the observations made by the cooperating amateur licensees in relation to the reported violations. This report shall include a statement as to the corrective measures taken to insure compliance with the rules.

§ 97.135 Third notice of same violation.

In every case where an amateur station licensee is cited within a period of 12 consecutive months for the third violation of §§ 97.61, 97.63, 97.65, 97.71, or 97.73, the station licensee if directed by the Commission, shall not operate the station and shall not permit it to be operated from 8 a.m. to 12 midnight, local time, except for the purposes of transmitting a prearranged test to be observed by a monitoring station of the Commission to be designated in each particular case. The station shall not be permitted to resume operation during these hours until the licensee is authorized by the Commission, following the test, to resume full-time operation. The results of the test and the licensee's record shall be considered in determining the advisability of suspending the operator license or revoking the station license, or both.

§ 97.137 Answers to notices of violations.

Any licensee receiving official notice of a violation of the terms of the Communications Act of 1934, as amended, any legislative act, Executive order, treaty to which the United States is a party, or the rules and regulations of the Federal Communications Commission, shall, within 10 days from such receipt, send a written answer direct to the office of the Commission originating the official notice: *Provided, however,* That if an answer cannot be sent or an acknowledgment made within such 10-day period by reason of illness or other unavoidable circumstances, acknowledgment and answer shall be made at the earliest practicable date with a satisfactory explanation of the delay. The answer to each notice shall be complete in itself and shall not be abbreviated by reference to other communications or answers to other notices. If the notice relates to some violation that may be due to the physical or electrical characteristics of transmitting apparatus, the answer shall state fully what steps, if any, are taken to prevent future violations, and if any new apparatus is to be installed, the date such apparatus was ordered, the name of the manufacturer, and promised date of delivery. If the notice of violation relates to some lack of attention or improper operation of the transmitter, the name of the operator in charge shall be given.

SUBPART F—RADIO AMATEUR CIVIL EMERGENCY SERVICE (RACES)

GENERAL

§ 97.161 Nature of this service.

(a) The Radio Amateur Civil Emergency Service provides for amateur radio operation for civil defense communications purposes only, during periods of local, regional or national civil emergencies, including any emergency which may necessitate invoking of the President's War Emergency Powers under the provisions of Section 606 of the Communications Act of 1934, as amended.

(b) Pursuant to the provisions of section 4(j) of the Communications Act of 1934, as amended, records relating to the Radio Amateur Civil Emergency Service shall not be open to general public inspection.

§ 97.163 Definitions.

For the purposes of this subpart, the following definitions are applicable:

(a) *Radio Amateur Civil Emergency Service.* A radiocommunication service carried on by licensed amateur radio stations while operating on specifically designated segments of the regularly allocated amateur frequency bands under the direction of authorized local, regional or federal civil defense officials pursuant to an approved civil defense communications plan.

(b) *Radio Amateur Civil Emergency Station.* An amateur radio station which is authorized to operate in the Radio Amateur Civil Emergency Service for the purpose of transmitting and receiving civil defense communications.

(c) *Civil defense communications.* Communications or signals essential to the conduct of civil defense activities of duly authorized civil defense organizations, including communications directly concerning safety of life, preservation of property, maintenance of law and order, alleviation of human suffering and need and dissemination of warnings of enemy attack to the civilian population in case of actual or impending armed attack or in any disaster or other incident endangering the public welfare. Such communications may also include transmissions necessary to establishment and maintenance of the radio system and communications essential to the training of civil defense personnel.

(d) *Civil defense authority.* The legally appointed Director of Civil Defense, or his authorized alternate or representative, for the particular geographical area (city, county, etc.) which a proposed radio station is intended to serve, and who is responsible to local governmental authority for protection and aid to the civilian population in the event of armed attack or of any disaster or other incident endangering public safety.

(e) *Civil Defense Communications Officer.* The official of any duly constituted civil defense organization having direct responsibility under the Director of that organization for the provision, organization, maintenance, readiness, and utilization of all means of communication to be used by such civil defense organization in the performance of its lawful functions.

(f) *Civil Defense Radio Officer.* The duly designated official of a legally constituted civil defense organization who is directly responsible either to the Communications Officer or to the Director of such civil defense organization for the provision, organization, maintenance, readiness, and utilization of radio communications facilities for civil defense use.

(g) *Radio Amateur Civil Emergency Network.* All radio amateur civil emergency stations intended to be included in the civil defense communications plan of the area concerned and which operate, or are to operate, in conjunction with a single control station. Such network may be made up of several separately authorized radio amateur civil emergency stations or units of such stations, or may be made up of several units of the same station operated at different locations. In addition, the same radio amateur civil emergency station or any unit of such station may be a part of more than one network; e.g., the control station of one network may also be the control station or a member station of another network operated in conjunction therewith.

§ 97.185 Single application for all equipment under one amateur station license.

Only one application need be filed for any one amateur station, including all transmitting equipment under the control of the licensee of that station, even though individual units of such station are capable of being operated and are intended to be operated independently at different locations, or as portable or mobile stations with no fixed locations. No distinction need be made between those units which are personally owned by the amateur station licensee and those units which are otherwise under his technical control for operation in this service.

§ 97.187 Issuance of station authorization.

An authorization to operate in this service will be issued in the discretion of the Commission upon satisfactory completion of all requirements of this subpart and proper certification that the requirements of the civil defense organization for which the station will be used have been or are being complied with. The station authorization (Form 481–3) will be forwarded to the Civil Defense Radio Officer for delivery to the applicant. Such authorization will be accompanied by a stub (Form 481–2) which may be retained by the civil defense radio officer for his records.

§ 97.189 Term of station authorization.

(a) Authorization to operate an amateur station in the Radio Amateur Civil Emergency Service will be issued for a term running concurrently with the term of the amateur radio station license. Application for renewal of such authorization shall be filed concurrently with application for renewal of the basic amateur radio station license.

(b) Whenever, under rules contained in Subparts A through E of this part, modification of the basic amateur station license becomes necessary, if such modification affects the information submitted with the original application for authorization in the Radio Amateur Civil Emergency Service, application for modification of the Radio Amateur Civil Emergency service station authorization shall be submitted concurrently therewith.

(c) Nothing in this section shall be construed to alter the Commission's authority to cancel or amend a station authorization in the Radio Amateur Civil Emergency Service in accordance with the applicant's agreement as indicated on the initial application for station authorization.

§ 97.191 Cancellation of station authorization.

(a) Each authorization for operation in the Radio Amateur Civil Emergency Service shall be issued with the express provision that such authorization is subject to revocation or cancellation without hearing whenever, in the opinion of the Commission, the security of the United States or the proper functioning of the Radio Amateur Civil Emergency Service would be served thereby.

(b) The station authorization shall be submitted to the Commission (via the Civil Defense Radio Officer) for cancellation under the following circumstances:

(1) The station for which the authorization was issued becomes inactive for a period of three months or it is not planned to use the station in the radio amateur civil emergency network for a period of at least three months.

(2) The basic amateur radio station license of the station has expired and has not been renewed.

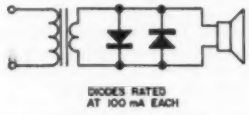
(3) In cases where the amateur radio station license and the radio amateur civil emergency station authorization have both been modified, the original authorization of the latter shall be submitted to the Commission immediately upon receipt by the licensee of a new or modified authorization.

(To be continued next month)

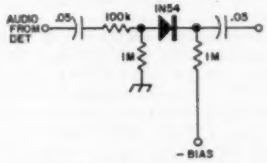
CIRCUITS, CIRCUITS, CIRCUITS..

The following circuits have appeared in the referenced books, magazines, application notes, etc. While we try to reproduce all of the information that should be needed by an experienced constructor, readers may want to avail themselves of the original sources for peace of mind.

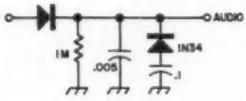
Readers are requested to pass along any interesting circuits that they discover in sources other than U.S. ham magazines. Circuits should be oriented toward amateur radio and experimentation rather than industrial or computer technology. Submit circuit with all parts values on it, a very brief explanation of the circuit and any additional parts information required, give the source and a note of permission to reprint from the copyright holder, if any, and the reward for a published circuit will be a choice of a 73 book. Send your circuits to 73 Circuits Page, 73 Magazine, Peterborough NH 03458.



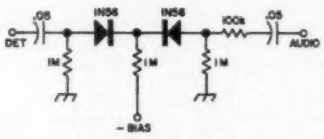
Shunt diode noise limiter for use across a loudspeaker.



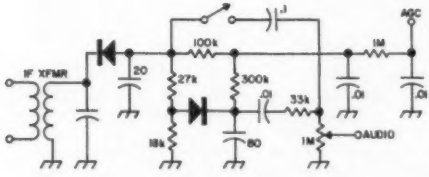
Half-wave series noise limiter with adjustable clipping level.



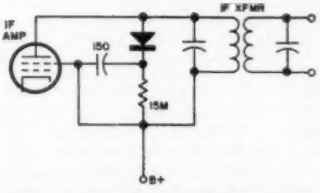
Shunt diode noise limiter that can be easily added to the input of an audio amplifier.



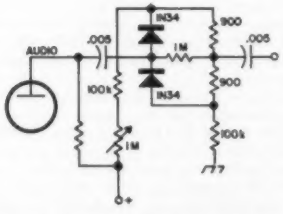
Full-wave series noise limiter.



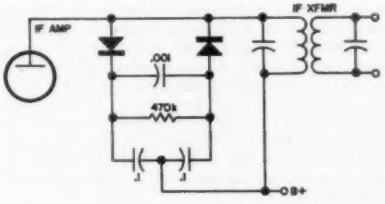
One of the best noise limiters is the "rate-of-change" limiter designed for TV audio in England.



This simple noise limiter is installed in an i-f stage for SSB and CW use. The diode must have high back resistance, low capacitance and short rise time.



This "trough" limiter will eliminate the background noise that is ignored by conventional limiters.



This is an improved version of the SSB i-f noise limiter above.

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You can have parts running out of your ears! Here are rafts of bags, each containing an assortment of specific parts. They're fantabulous!

100 CM–20 MICA CONDENSERS. Mixed values. **$5.00**
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R–108/GRC FM 15 & 10 METER RECEIVER One of the Army's latest communications receivers! Covers 20–29 mc in one band. Receives AM with minor modification. Has 3 preset channels, easily changed from front panel. (No crystals). Makes great monitoring receiver, satellite or CB band. Comes with modification and AC power supply instructions. New or like new. Special at ..... **$19.95.**
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LED 1 OR – Pack of 10 discrete red lens LEDs, various MV5020-series types. **$1.50**

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10 or more, $0.10 ea.
Excellent for use with the clock chips.

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NO.	I_{DSS} (ma) min	I_{DSS} (ma) max	V_P (v) min	V_P (v) max	PRICE
NJF10	1	25	.7	9	**3/$1.00**
NJF11	5	170	.5	10	**4/$1.00**
NJF12	.1	10	.5	8	**4/$1.00**
NJF13	.02	1	.5	6	**3/$1.00**
NJF14	.5	17	.5	8	**4/$1.00**
P-CHANNEL:					
PJF11	5	90	.5	10	**4/$1.00**
PJF14	.3	20	.5	9	**4/$1.00**

Notes:
NJF10 is usable to 450 MHz;
NJF11 and PJF11 are complements, high-current and good to 100 MHz;
NJF12 is general purpose;
NJF13 is a low-current high-impedance type;
NJF14 and PJF 14 are complements, general purpose and good to 50 MHz.

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If you are looking for a fine receiver, check out the TEN TEC 315 for just **$229** The CW Filter **$14.95**

Speaking of receivers, look at these GREAT BARRY BUYS. . .
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Other Great Christmas Buys. . .

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IC 22 . . . . . **$289.00**

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B & W 334 1 KW Dummy Load and Wattmeter DC-300 MHz . . . . . just **$139.95** postpaid.

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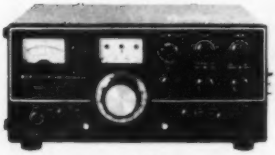

KENWOOD TS-520

The new TS-520 is the transceiver you have wanted, but could not buy until now. It is a no-compromise, do everything, go everywhere 5 band transceiver for SSB or CW that performs equally well at home, in an automobile, airplane, boat or trailer. The TS-520 features built-in AC power supply, built-in 12 volt DC power supply, built-in VOX with adjustable gain delay and anti-VOX ..

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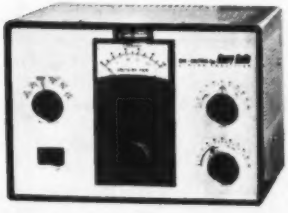
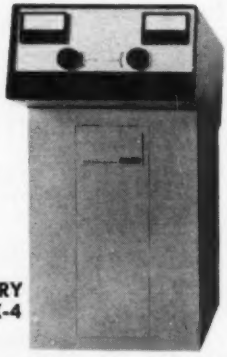
. . . a winning pair!



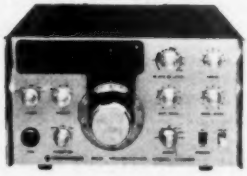
HENRY 2K-ULTRA

There has never been an amateur linear amplifier like the new 2K-ULTRA. Small and lightweight, yet rugged and reliable . . . all that the name implies. The ULTRA loafs along at full legal power without even the sound of a blower. Its anode heat is silently and efficiently conducted to a heat sink through the use of a pair of Eimac 8873 tubes. In fact, all of its components are the very best obtainable. The price . . . $845.00.



HENRY 2K-4

The 2K-4 linear amplifier offers engineering, construction and features second to none, and at a price that makes it the best amplifier value ever offered to the amateur. Constructed with a ruggedness guaranteed to provide a long life of reliable service, its heavy duty components allow it to loaf along even at full legal power. If you want to put that strong clear signal on the air that you've probably heard from other 2K users, now is the time. Move up to the 2K-4. Floor console . . . $845.00.



KENWOOD T-599A

The T-599A is mostly solid state . . . only 3 tubes, has built-in power supply, full metering (ALC, Ip, RF output & high voltage), CW-LSB-USB-AM operation, 1 KHz frequency readout, smooth easy VFO action, built-in VOX (with delay, sensitivity and anti-VOX adjustments), built-in semi-automatic CW with sidetone, full amateur band coverage 10 thru 80, versatile cross channel operation with the R-599A. The price . . . $459.00

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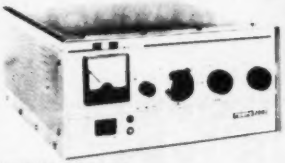

TEMPO/2001

Small, but powerful and reliable . . . the 2001 linear amplifier offers a full kilowatt of power for SSB operation in an unbelievably compact package. It uses two Eimac 8874 grounded grid triodes . . . has a built-in solid state power supply, built-in internal blower, a relative RF power indicator, full amateur band coverage from 80-10 meters and is completely wired and ready for operation. The price . . . $545.00

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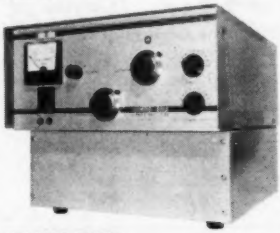
. . . the best value in SSB transceivers on the market today. Look at the specifications . . . look at the price tag . . . ask any of the thousands of Tempo ONE owners about its reliability, and the reason for its unparalled popularity will be obvious. Features solid state VFO, receiver offset tuning (clarifier), all amateur bands 80 thru 10 meters, SSB upper and lower sideband, CW and AM. The price . . . $349.00

TEMPO/FMH

So much for so little! 2 watt VHF/FM hand held. 6 Channel capability, solid state, 12 VDC, 144-148 MHz (any two MHz), includes 1 pair of crystals, built-in charging terminals for ni-cad cells, S-meter, battery level meter, telescoping whip antenna, internal speaker & microphone. $199.00.



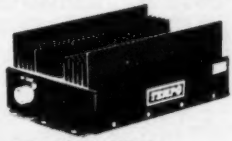
TEMPO/6N2

The Tempo 6N2 amplifier combines most of the fine features of the 2001 for 6 and 2 meter amateur operation. The amplifier uses the same small cabinet, the same modern tubes, the same inherent quality for 2000 watts PEP input on SSB or 1000 watts input on FM or CW. The rig is completely wired in one small package with an internal solid-state power supply, built-in blower, and RF relative power indicator. The price . . . $695.00.

TEMPO/CL-146

The CL-146 offers operation on the 146 MHz amateur band. The price includes a microphone, power cord, mounting bracket and one pair of crystals. A full line of accessories is also available.

• 12 channel capability • 13 watts or a power saving 3 watts • All solid state, 12 VDC – 144 to 148 MHz (any two MHz without retuning) • Supplied with one pair of crystals • RF output meter, S-meter, receiver detector meter • Provisions for external oscillator • Monitor feature • Audio output at front panel • Internal speaker • The price: $299.00.



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Tempo is exclusive distributor for a full line of superb quality solid state 2 meter, amateur VHF FM amplifiers designed for mobile or base station operation. Output ranges from 25 to 130 watts for drive power of 1 to 25 watts. Commercial, type-accepted amplifiers are available also. Please write for prices and specifications.

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Quantity	Channel MHz	Crystal Freq.	Equip. Make and Model

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7 SEGMENT readouts 2 in 1 pac plus space. Ideal for clocks. 6 digits for **$5.95**
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74C20	.70	CD4011	.70	LM 380	1.75	
74C73	1.65	CD4012	.70	741T	.45	
74C74	1.50	CD4013	1.50	CA 3028	.75	
74C76	1.65	CD4016	1.50	CA 3065	.75	
74C107	1.65	CD4019	1.40	CA 3086	.45	
74C151	3.00	CD4023	.70			
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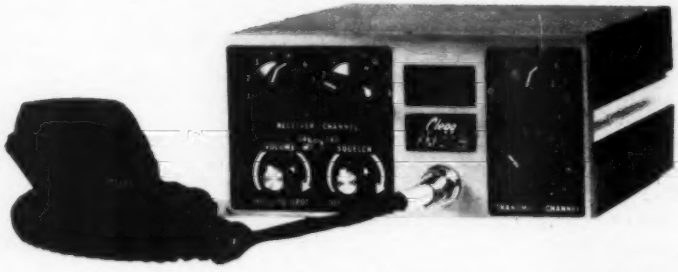

Down to $429.95. . .The FM-27B Transceiver
During Clegg's 1-Month Factory Authorized Holiday Sale!

CHECK THESE SPECIFICATIONS

GENERAL

POWER REQUIREMENTS: 12 to 14 VDC
Current Consumption at 13.5 VDC:
Receive: 4 amps squelched, 1.2 amps unsquelched.
Transmit: 6 amps max.

DIMENSIONS: 7 3/8" x 3 1/2" x 9 1/4" deep; 4 lbs. net weight.

RECEIVER

TUNING RANGE: 146.00 to 148.00 MHz, continuously tuneable with reset capability of approx. 1 KHz to any frequency in range.

SENSITIVITY: .35 μv max. for 20 db quieting; .1 μv for reliable squelch action.

SELECTIVITY: 11 KHz at 3 db; Less than 30 KHz at 70 db. Adjacent (30 KHz spaced) channel rejection more than 70 db.

AUDIO OUTPUT: 2.0 watts (min.) at less than 10% THD into internal or external ohm speaker.

TRANSMITTER

TUNING RANGE AND CONTROLS: Same as RECEIVER.

POWER OUTPUT: 25 watts Min. into 50 ohm load. P/A transistor protected for infinite VSWR.

MODULATION: Internally adjustable up to 10 KHz deviation and up to 12 db peak clipping.

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MOTOROLA – Big name, but now priced for the Ham. The Metrum II features high Quality and High Performance in the Motorola Tradition. The Metrum II has 12 Channel capability (146.94 MHz supplied) And requires only one crystal per channel. Repeater operation is accomplished by installing an optional Repeater Offset crystal. In Repeat mode, the transmitter frequency is shifted.

Receiver specs are on par with their commercial models; **Guaranteed**: .35uv-20db quieting (.25uv sinad), Intermod –70db, Spurious and Image rejection –65db. Very sensitive! – But provides "Garbage-free" reception in metro areas where some rigs are "Wiped out" by adjacent channel interference and intermod.

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METRUM II 10 watt model....	**$399.95**
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NOTE: Our 45 MHz receive synthesizers are now in production. Call us for details.
IMPORTANT: When ordering be sure to state the output frequency you want.

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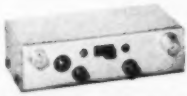

HIGH GAIN ● LOW NOISE

35 dB power gain, 2.5—3.0 dB N F. at 150 MHz, 2 stage, R.F. protected, dual-gate MOSFETS. Manual gain control and provision for AGC. 4-3/8" x 1-7/8" x 1-3/8" aluminum case with BNC receptacles and power switch. Available factory tuned to the frequency of your choice from 5 MHz to 350 MHz with approximately 3% bandwidth. Up to 10% B W. available on special order.

Model 201 price:
5—200 MHz $24.95
201—350 MHz $28.95

HOW TO ORDER:
All the items on this page are available only from Vanguard Labs. For receivers and converters, state model input and output frequencies and bandwidth were applicable. Remit in full, including sales tax if you reside in New York State, direct to Vanguard Labs. Prices include postage by regular parcel post. For air mail or special delivery include extra amount; excess will be refunded. Send money order or certified check for faster shipment.

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40 dB GAIN 2.5—3.0 N.F. ● 150 MHz

2 RF stages with transient protected dual-gate MOSFETS give this converter the high gain and low noise you need for receiving very weak signals. The mixer stage is also a dual-gate MOSFET as it greatly reduces spurious mixing products — some by as much as 100 dB over that obtained with bipolar mixers. A bipolar oscillator using 3rd or 5th overtone plug-in crystals is followed by a harmonic bandpass filter, and where necessary an additional amplifier is used to assure the correct amount of drive to the mixer. Available in your choice of input frequencies from 5—350 MHz and with any output you choose within this range. The usable bandwidth is approx. 3% of the input frequency with a maximum of 4 MHz. Wider bandwidths are available on special order. Although any frequency combination is possible (including converting up) best results are obtained if you choose an output frequency not more than 1/3 or less than 1/30 of the input frequency. Enclosed in a 4-3/8" x 3" x 1-1/4" aluminum case with BNC receptacles, power and antenna transfer switch. Thousands of our converters are now in use by satisfied customers, many of whom are government agencies and universities.

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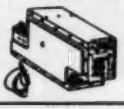

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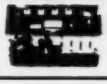

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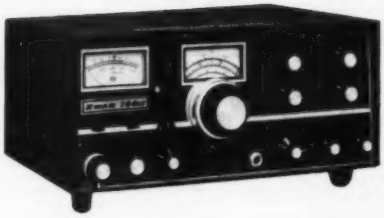

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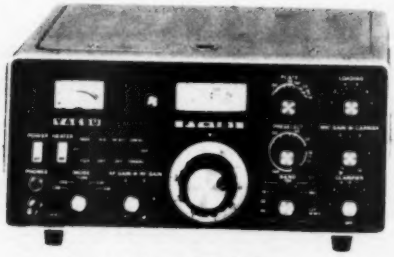

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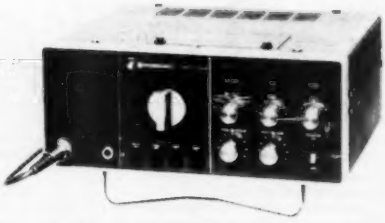

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All devices are first quality and are fully guaranteed.

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The Best Vertical There IS!

80 through 10 meters

hy-gain 18AVT/WB

New, from the inventors of wideband verticals.

Pack some punch! All the omnidirectional performance of Hy-Gain's famous 14AVQ/WB...plus 80 meter capability! Unrivaled performance, rugged extra heavy duty construction, and the price you want...all in one powerful package!

- Automatic switching on all five bands through the use of three beefed-up Hy-Q traps...featuring extra large diameter coils for exceptional L/C ratio and extremely high Q.
- Recessed coax connector furnished.
- Top loading coil and four element static hat.
- Constructed of extra heavy wall high tensile aluminum.
- Hot performance all the way across the band with just one setting (10 through 40).
- Hy-Q traps effectively isolate antenna sections for full 1/4 wave resonance on all bands.
- No dissimilar metals to cause noise.
- SWR 2:1 or less at band edges.
- Maximum legal power with low frequency drift.
- Exceedingly low radiation angle makes DX and long haul contacts a cinch...whether roof or ground mounted.
- Very low RF absorption from insulating materials.

The 18AVT/WB is constructed of extra heavy duty, taper swaged, seamless aircraft aluminum with full circumference, corrosion resistant compression clamps at all tubing joints. This antenna is so rigid, so rugged...that its full 25' height may be mounted using only a 12" double grip mast bracket...no guy wires, no extra support...the 18AVT/WB just stands up and dishes it out!

Order No. 386 **$79.95**

Get the strength, the performance and the price you want...from the man who sells the complete line of quality Hy-Gain equipment.

HY-GAIN ELECTRONICS CORPORATION

Dept.CM, 8601 Northeast Highway Six Lincoln, NE 68507
402/434-9151 Telex 48-6424

The most powerful signals under the sun!

hy-gain

Redesigned

HAMCAT

Out-hustles them all!

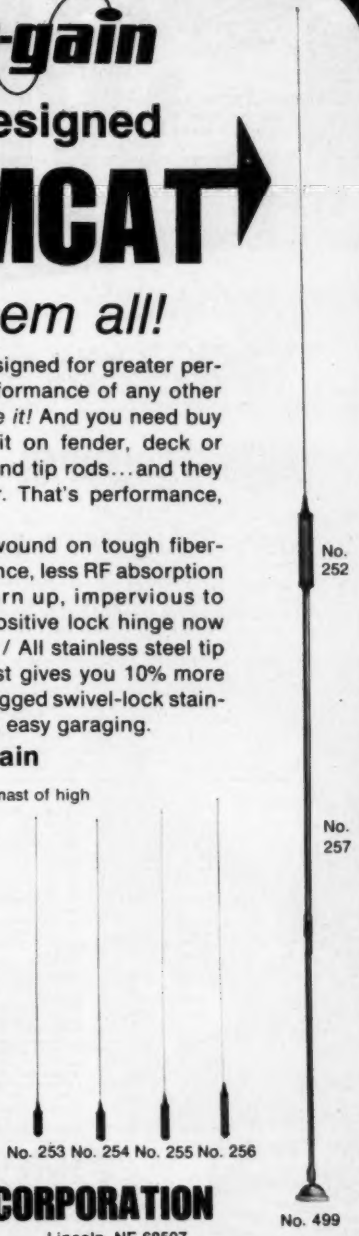
The famous HAMCAT...now redesigned for greater performance...*equals* or *exceeds* the performance of any other Amateur Mobile antenna. *We guarantee it!* And you need buy only one mast...whether you mount it on fender, deck or bumper. There's just one set of coils and tip rods...and they all stand up to maximum legal power. That's performance, that's value...*THAT'S HY-GAIN!*

Original Hy-Q "quick changer" coils wound on tough fiberglass coil forms for greater heat resistance, less RF absorption / Fiberglass shielded coils can't burn up, impervious to weather / Shake-proof, rattle-proof, positive lock hinge now even stronger...eliminates radio noise / All stainless steel tip rods won't bend or break / Full 5' mast gives you 10% more radiating area than the competition / Rugged swivel-lock stainless steel base for quick band changes, easy garaging.

Get the Hamcat...from Hy-Gain

Order No. 257 All new design 5' long heavy duty mast of high strength heavy wall tubing	$17.95
Order No. 252 75 meter mobile coil	$19.95
Order No. 256 40 meter mobile coil	$17.95
Order No. 255 20 meter mobile coil	$15.95
Order No. 254 15 meter mobile coil	$12.95
Order No. 253 10 meter mobile coil	$11.95
Order No. 499 Flush body mount	$ 9.95

COIL ASSEMBLY CUT-AWAY
A. Chrome plated brass fittings.
B. Inner fiberglass core.
C. Precision coil.
D. Outer fiberglass shield.
All permanently assembled and completely impregnated with special moisture-proof compound.



HY-GAIN ELECTRONICS CORPORATION

Dept. CM, 8601 Northeast Highway Six
Lincoln, NE 68507
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Telex 48-6424

GTX-2
30 WATTS OUTPUT

Genave
100% American Made

GTX-200
30 WATTS OUTPUT

(1) GTX-2 (built-in DC PS) and 94/94 ..... $249.95
(2) Deluxe 8 Amp Regulated AC Power Supply $69.95
(3) 2 extra crystals your choice (stock list) $12.00
REGULAR – $331.90
OUR SPECIAL PACKAGE PRICE – $269.00

100 channel combinations; features independent selection of transmit and receive frequencies, and switch for preselected pairing.
(1) GTX-200 (built-in DC PS) & 94/94 ..... $259.95
(2) Deluxe 8 Amp regulated AC Power Supply $69.95
(3) 2 Extra xtals your choice (stock list) $12.00
REGULAR – $341.90
OUR SPECIAL PACKAGE PRICE – $279.00

GTX-10
10 WATTS OUTPUT

(1) GTX-10 (built-in DC PS) & 94/94 ..... $199.95
(2) AC Power Supply $34.95
(3) 2 Extra xtals your choice (stock list) $12.00
REGULAR – $246.90
OUR SPECIAL PACKAGE PRICE – $199.95
Please add $10.00 Substituting HAMPAK for AC on GTX-10 Package. With HAMPAK & AC $229.00

*** FLASH * FLASH * FLASH ***

Look at what you get for NO - REPEAT - NO EXTRA CHARGE: The GTX-2 and the GTX-200 have a super-sensitive Dual-Gate Mos Fet pre-amplifier Built-in the receiver front end for superb, less than .25 microvolt sensitivity. THE BEST receiver now even better!

CLEGG FM-27Bs
Reg. $479.95, or with Clegg AC... Reg. $559
WRITE FOR SPECIAL DEAL!

HAMPAK

Battery pack for GTX-10 portable operation. Uses 10 D cells (not included). Includes portable antenna, carrying handle & mike clip $39.95

MIDLAND 13-520
Reg. $229.95
WRITE FOR SPECIAL DEAL!

- **SUPERB QUALITY**
- 2 watts, 6 channels with carrying case and 16/76, 34/94 & 94/94.
- Please write for special packages with NI-CAD pack, charger, etc.

30 WATTS OUTPUT. ALL SOLID STATE (no tubes) TRUE FM (not phase modulation) for superb audio quality. 10 channels in GTX-2 & GTX-10 with 146.94/146.94 included. Three pole low pass filter on both transmit and receive. 1 watt low power position. Provision for tone encoder. Simple internal strapping provision allows multi-channel use of any crystal in GTX-2 and GTX-10. Microphone and LOCKABLE MOBILE MOUNTING BRACKET SUPPLIED. G-10 GLASS BOARDS. Professional level construction by distinguished Avionics Mfg. – General Aviation Electronics, Inc. The finest amateur FM transeiver available at any price. Size. 9 x 6½ x 2½. Weight 5 lbs. Current Drain: Receive: .09 amps, Transmit: High 5.0 amps, Low: 1.7 amps, Made in U.S.A.

REGENCY, CLEGG, SBE, INOUE, GLADDING, MIIDA, CUSHCRAFT, DATA ENG., BIRD, OLIVER SWAN (KLM), HY-GAIN, SAVOY, B&K, LEADER, KENWOOD, TEMPO, TEN TEC, DX ENG., MINI PRODUCTS, SWAN, MIDLAND, ETC., IN STOCK – PLEASE WRITE FOR QUOTE.

B & K	Reg.	Our Price
WRITE FOR SPECIAL LIST		
CDR		
HAM-M's, new	129.00	99.00
CLEGG		
FM-27B, 1 mo. new	479.00	389.00
COLLINS		
62S-1 6 & 2 transverter	695.00	595.00
KWM-1 xcvr w/516F AC and 312B-3 (same as 312B-4) like new.	495.00	375.00
DRAKE		
TR-22, like new	179.00	149.00
2-NT CW xmitter, new cond.	119.00	89.00
2-B rcvr w/2BQ "Q" mult/spk	219.00	169.00
SW-4A Gen. cov. rcvr., like new	249.00	189.00
Marker Luxury 2M FM, built-in AC/DC w/mount, mike	269.00	225.00
ENCO		
232 P to P VTVM kit, new	34.95	19.00
GALAXY		
FM-210 2M FM w/AC 210 AC ps and power booster 6 xtals and mike	169.00	109.00
GLADDING		
25 2m FM 25 watt w/12 xtals, like new	199.00	159.00
HALLICRAFTERS		
SR-42A 2m xcvr, new cond 2 xtals, built-in AC/DC	149.00	99.00
HA-26 VFO for above (6 & 2 VFO)	39.00	25.00
SR-150 80-10 xcvr w/PS-150 AC/spk	350.00	249.00
SX-71 rcvr.	109.00	49.00
FPM-300 1 mo. new, factory checked	475.00	399.00
HEATH		
IO-102 DC-5Mc scope, fact. wired, new cond.	189.00	119.00
HD-11 "Q" mult, built-in AC/ps	15.00	8.00
SB-10, as is		19.00
HW-17A AM/FM 2m xcvr, built-in AC/DC ps, mike, w/HWA-17-2 FM adaptor	189.00	125.00
KNIGHT		
TR-108 15 watt 2m xcvr, built-in AC/DC ps, mike	99.00	79.00
T-150 xmitter	69.00	49.00
HY-GAIN		
LP-62 log periodic 6 & 2 ant, gain 2m 15 dB/6m 8 dB, new	62.50	39.00
KENWOOD		
R-599 receiver, new, warranty	389.00	309.00
T-599 xmitter, new, warranty	429.00	319.00
R-599 rcvr w/6 & 2 conv. installed, new cond.	389.00	299.00
T-599 xmitter, like new	349.00	279.00
R-599 rcvr, like new	329.00	259.00
MIIDA: Electronic Calculators and DVM (all 1 yr. warranty)		
MC-840 8 digit calc., new	119.95	87.00
MC-830K 8 digit calc., new, AC/DC built-in	149.95	109.00
MC-1214 16 digit calc., with/memory new	199.95	139.00
No. 8854 autoranging 4 ½ digit digital multimeter w/BCD output	699.00	495.00
MIDLAND		
13-509 220 FM, 2 mos. new	219.00	169.00
NATIONAL		
NCL-2000 2KW linear, like new	349.00	250.00
POLYCOM		
628 18 watt 6 & 2m xcvr, mike, built-in AC/DC and VFO	179.00	139.00
SWAN		
350 (late) 117X AC, spk, DC mod.	369.00	289.00
250 6m xcvr w/117X AC and DC mod.	389.00	269.00
STANDARD		
SR-C 826M w/4 chans. new cond.	389.00	229.00
TPL/TEMPO		
24 hr. digital clock, new	89.00	59.00
LW-1500 2KW dummy load/ wattmeter	119.00	89.00
TEN-TEC		
Argonaut 406 SSB 80-10 xcvr w/505 linear, like new	389.00	319.00
PM-2-B 80-40-20 xcvr, new	66.95	39.00

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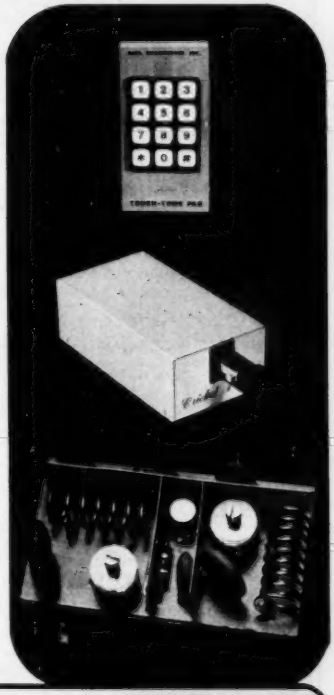


TOUCH TONE PADS

More features than any other pad including built-in monitor speaker and latest Phase-Lock loop circuitry.

TTP-1 Standard pad for portable transceiver mounting.

TTP-2 Standard pad in attractive case for home or mobile use.

TTP-3 Mini-pad in attractive case for home or mobile use.

TTP-4 Mini-pad for portable transceiver mounting.

TTP-1, 2, 3 & 4, Sh. wt. 1 lb. $44.50

TTP-1K, 2K, 3K & 4K, Sh. wt. 1 lb. $34.50

CRICKET 1

A popularly priced IC keyer with more features for your dollar. Cricket 1 is a small size, solid state keyer designed for the beginner as well as the most advanced operator. It provides the user with fatigue-free sending and its clean, crisp CW allows for easy copying at all speeds. Turned on its side, the Cricket can be used as a straight key for manual keying.

CRICKET 1 Sh. Wt. 3 lbs. $49.95

2-METER PREAMP

Specially made for both OLD and NEW receivers. The smallest and most powerful preamp available. Provides 20dB gain at 2.5 N.F. to bring in the weakest signals.

Sh. wt. 4 oz. $9.50 kit

$12.50 wired

Please include sufficient postage for shipping.

DATA ENGINEERING INC.

BANKAMERICARD master charge

Ravenswood Industrial Park, Springfield, Va. 22151

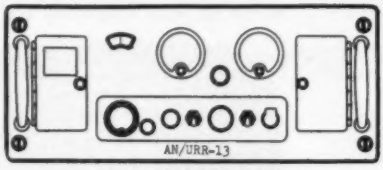
5554 Port Royal Road • 703-321-7171

RT-70/GRC **$20 each, 3/$50**

Latest government release. Transmitter-Receiver RT-70/GRC covers 47 to 58.4 mc FM. Requires only 90 Volts dc and 6 volts dc. Used, visually OK, supplied with schematic.

1 MC crystal used for calibration $4.00

116 page maintenance manual for GRC $2.00



URR–13 RECEIVER

Listen in to jet planes, Air Force 1, U-2 spy planes, FBI, etc. They use the frequency covered by this receiver . . . 220 to 400 mc. Possibilities of covering the 220-450 mc band by re-tuning. Operates from regular 115 Volt 60 cycle, requires only antenna and speaker. Tuneable through the frequency, direct reading dial. Schematic and write up on this set furnished.

Visually OK condition ... URR-13 - $50.00

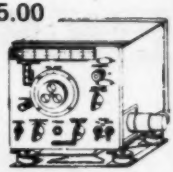
CALCULATOR KEYBOARD

A nice purchase by us due to contract termination. Brand new, 2 styles available, one for use with Gen. Inst. C-500 chip, another for use with Cal-Tex 5001 and 5002 chips or Mostek 5010 and 5012 chips. Measure approx. 2.6 x 3.7 inches.

Calculator Keyboard - $8.00 (either one), any 2 for $15.00

LM FREQ METER $35.00

Lowest price yet. W/tubes, crystal and original calibration book. Look OK but unchecked. Typical schematic furnished. 8 lbs. .....#LM 35.00



TCS RCVR or XMTR

Used, look good, with schematic, receiver or transmitter. Frequency range 1.5 to 12 MC. Three bands, VFO or crystal, voice and CW. These sets Collins design, becoming scarce.

RCVR or XMTR $35.00

RCA INJECTION LASER DIODES

Another SUPER SCOOP by Meshna. Brand new RCA packaged, considered obsolete by RCA but what an exotic opto-electronic device for the sophisticated experimenter. Only several hundred on hand. Values shown are approx. as each diode characteristic varies. Each is marked with correct value.

6 WATT $10.00

10 WATT $15.00

RCA TD-XI TUNNEL DIODE

Original packaged, each factory marked, with spec sheet.

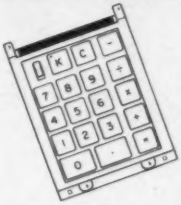
$1.25 each, 5/$5.00.

15 AMP BATTERY CHARGER

Brand new GE transformer, 25 amp fullwave bridge. Output approximately 15 volts up to 15 amps. Ideal battery charger or DC source for general use. With instructions , assembled in minutes.

PK–4 **$7.50**

Meshna Postage extra on above. **MESHNA PO Bx 62 E. Lynn Mass. 01904**



CALCULATOR KEYBOARDS

Brand new keyboards for hand held calculators. Two styles available. One for CAL TEX 5001–5002–5012 or MOSTEK 5010–5012. Another for use with GEN INSTR C500.

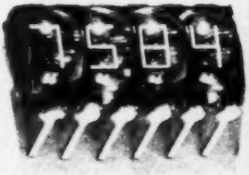
$8.00 each, 2/$15.00

CT 5005 CALCULATOR ON A CHIP

Single MOS chip with all logic required for 12 digit 4 function desk top calculator with extra storage register for memory or constant. Multiplexed 7 segment outputs for LED, Incandescent, Fluorescent or Gas Discharge displays. Brand new and bargain priced. With Specs.

$8.00 each, 2/$15.00

HP LED DISPLAYS



Brand new 4-on-strip LED display. End butt two strips and come up with 8 digit readout. An unheard of SUPER VALUE at $8.00 per strip of 4 digits. Two strips (8 digits) $15.00. Another strip . . . this one a clock readout. The strip has 2 digits . . . space . . . 2 digits. Perfect for reading hours & minutes.

$8.00 per strip, 2/$15.00

CMOS 4814 HEX INVERTER

DIP with operation 3–18 Volts. Dual diode protection against static charge destruction. Dielectrically isolated complimentary MOS.

$1.00 each, 12/$10.00

DUAL 16 BIT MEMORY

Serial MOS by PHILCO in TO–5 case. Brand new with 2 page specs.

#PLR 532 **$1.00 each, 12/$1.00**

PHONE PATCH KIT

Includes all parts, instructions, cabinet.

AM PATCH – $5.00 **SSB PATCH – $9.00**

2048 BIT MOS MEMORY

MOS LSI random access memory #NEC 6003. All inputs except clock are TTL compatible. 2048 word by 1 bit. 22 pin ceramic DIP. With specs.

$9.00 each, 2/$17.00

VOLTAGE CONTROLLED OSCILLATOR

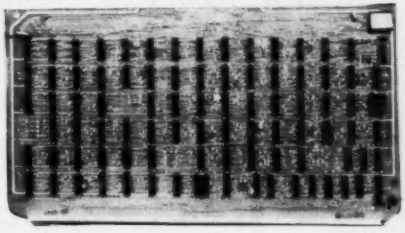
Rare item. See Pop. Elect. Mag. Oct. 1973 for uses. In 14 pin DIP package.

#8038C **$9.95 each, 2/$18.00**

ASCII KEYBOARDS W/ENCODER

From Raytheon, new or like new. 5 extra function buttons each side. Open faced, no cabinet. Schematic provided. Price is postpaid world wide.

$46.00



7400 SERIES ICs

Talk about bargains . . . this is a whopper. Due to quantity on ihand, we are reducing this item to a new MESHNA MESHU GINA deal. About 100 devices, all marked and easily removed. With shrinking supplies and upward direction of prices, this makes it well worth going into the salvage business. This Super Mother Board can be stolen for $6.00 each or 6 for $25.00. We also have these in ST 600 series DTL. So give your choice . . . 7400 series or ST 600 series. Mix-N-Match if you wish.

#SAN **$6.00 each, 6/$25.00**

Meshna

Postage extra on above. **MESHNA PO Bx 62 E. Lynn Mass. 01904**

DuPage FM

WILL NOT BE UNDERSOLD!

Since we cannot contact each of you individually we would like to take this opportunity to thank you for all your business in 1973 and to wish you . . .

A HAPPY AND PROSPEROUS 1974!

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INTERNATIONAL ELECTRONICS UNLIMITED

YEAR END SPECIALS

7402	.22 ea.	1101	2.00 ea.	MM5312 (24 pin) Clock Chip with spec sheet.....$7.95 ea.
7437	.45 ea.	8223	5.95 ea.	5002LSI (40 pin) Calculator Chip with spec sheet.....$7.95 ea.
7442	1.05 ea.	MAN1	3.50 ea.	
7453	.29 ea.	DL707	3.00 ea.	
7473	.48 ea.	MV10B	.20 ea.	
7490	1.10 ea.	MV5020	.30 ea.	MOS Grab Baq
7493	.95 ea.	Me4(TO18)	.50 ea.	8 Untested MOS Mix (dip) $2.00
74123	1.05 ea.	LM309K	1.75 ea.	50 Untested MOS Mix (dip) $10.00

special prices in effect through December

TTL

7400	.25	7430	.25	7470	.50	74123	1.15
7401	.25	7432	.30	7473	.55	74145	1.25
7402	.25	7437	.50	7474	.55	74151	1.05
7403	.25	7440	.25	7475	.95	74153	1.45
7404	.29	7441	1.25	7476	.55	74154	1.75
7405	.27	7442	1.15	7483	1.25	74155	1.35
7406	.55	7443	1.25	7485	1.20	74157	1.50
7408	.29	7444	1.30	7486	.55	74161	1.65
7409	.29	7445	1.25	7489	3.25	74164	2.95
7410	.25	7446	1.45	7490	1.25	74165	2.95
7411	.35	7447	1.45	7492	1.05	74175	2.95
7413	.95	7448	1.50	7493	1.05	74181	4.50
7420	.25	7450	.29	7494	1.10	74192	1.65
7423	.37	7451	.32	7495	1.05	74193	1.65
7425	.39	7453	.32	7496	1.05	74194	1.65
		7460	.30	74121	.55	75195	1.15

LINEAR

LM301 TO5	.45
LM302 TO5	.95
LM304 TO5	1.25
LM308 TO5	1.25
LM309K TO3	1.95
LM309H TO5	1.25
LM311 TO5	1.25
LM380 Dip	1.75
LM709 TO5-Dip	.39
LM723 Dip	.75
LM741 TO5-Dip	.45
LM747 Dip	.95

LED

MV10B Visible red SUPER SPECIAL	.25 ea
MV50 type red emitting	.25 ea or 5/1.00
MV5020 type Large red	.35 ea or 3/1.00
ME4 Infra red TO18	.69 ea
MAN 1 The Original	4.25 ea
MAN 3 type	1.95 ea, 3 or more 1.49 ea
MAN 4 type	2.75 ea, 3 or more 2.50 ea
Data-Lite 707 (MAN 1 repl)	3.25 ea

PHASE-LOCKED LOOP

NE565	2.95
NE566	2.95
NE567	2.95

MEMORIES-with data

1101	2.95
1103	7.95
7489	3.25
8223	6.95

8000 Series

8091	.69
8092	.69
8093	.69
8094	.69
8095	.69
8123	1.75
8214	1.95
8280	.95
8520	1.45
8551	1.95
8810	.95
8812	1.25
8831	1.95
8836	1.25

CALCULATOR CHIPS

5001 LSI (40 pin) with data.....6.95 ea.
5002 LSI (40 pin) with data.....8.95 ea.
5005 LSI (40 pin) with data.....10.95 ea.

Data only for above chips (refundable with purchase) $1.00

Low Power Devices

74L00	.40	74L72	.60
74L02	.40	74L73	.80
74L04	.40	74L74	.80
74L10	.40	74L78	.80
74L16	.40	74L85	1.25
74L20	.40	74L86	.95
74L30	.40	74L90	1.75
74L42	.80	74L93	1.75
74L51	.40	74L95	1.75
74L71	.60	74L164	2.95

DIGITAL CLOCK. . . on a Chip

MM5311	(28 pin)	with spec sheet	11.95 ea.
MM5312	(24 pin)	with spec sheet	8.95 ea.
MM5314	(24 pin)	with spec sheet	10.95 ea.
MM5316	(40 pin)	with spec sheet	51.95 ea.

10% off on orders of $25.00 or more

Satisfaction guaranteed. All items except as noted are fully tested. Minimum order $5.00 prepaid in US and Canada. California residents add sales tax. Orders filled within 3 days after receipt. Please add $.50 per spec sheet for items priced at less than $1.00 each.

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JUGE

NEW

SWAN MONOBANDER

At the time this ad is being prepared, we have a new MB-40 prototype for field testing, and with 13.5 VDC in, ours puts out over *60 WATTS* key down!! Swan's previous 15 watt rating has been changed . . . . . somewhat.

Monobanders are completely SWR protected — a shorted or open load won't hurt them . . . and all are bandpass coupled to the antenna — no tuning required.

Size — looking down from the top, if you placed this open magazine on the radio, short side of the magazine to the front, the radio is about ½ inch narrower than the magazine and 2 inches shorter. This is THE RADIO for problem no-space mobile installations.

THE BEST PART IS YET TO COME:

MB-80A	*80 Meters*	**$299.95**	**100w PEP**
MB-40A	*40 Meters*	**$299.95**	
MB-20A	*20 Meters*	**$299.95**	

. . . so the cost of going mobile on sideband is proably less than what it would cost you to trade the old fixed rig on anyother transceiver, and you keep the fixed rig.

Financing available through General Electric Credit, $30.00 down and only $10.00 monthly.

. . . or, use your Swan credit card — 10% down. Write today for credit application.

Send your $30.00 to hold your new Monobander . . . TODAY!

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111811 HARRY HINES
DALLAS, TEX 75229

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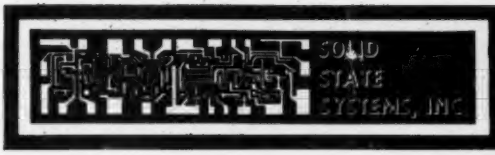
SSSI

CATALOG



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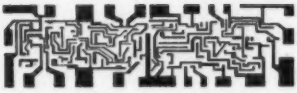

SOLID STATE SYSTEMS, INC.

800 N. PROVIDENCE RD. (314) 443-3673 TWX 910-760-1453
COLUMBIA, MISSOURI 65201

Dear Customer:

We are pleased to offer you this Winter 1973 Edition of our complete parts catalog. Those of you that have received previous catalogs will want to take notice of the new items that have been added. For instance, we are now carrying a full range of 5% type RCR resistors in addition to the 10% resistors we have always stocked. We hope to continue our trend toward these additions so that we can more completely serve your needs.

As our company has grown and the number of orders per day has increased, it has become necessary to request that certain items be ordered in exact multiples of five or ten. This allows us to prepackage many items and process each order with greater speed and accuracy. We ask that our customers pay particular attention to this ordering feature as this will save time consuming correspondence for both of us.

Those of you that have been with us since our inception will be familiar with our policy of 24 hour service and we want to again emphasize that we stress this policy to all our employees. We know how frustrating long delays can be when you are waiting for your order and we have built our reputation on FAST SERVICE and the stocking of only FIRST RUN, FACTORY TESTED COMPONENTS. We guarantee to replace any defective items if you will call or write for a Return Authorization.

Other features to note are our Toll Free Lines to our Order Desk (open 7 a.m. to 9 p.m. Monday through Friday and 8 a.m. to 4 p.m. on Saturday) and our offer of free data sheets for all our integrated circuits and readouts. A special column on the order blank has been provided for this request. You will also notice the use of grouping code numbers throughout the catalog. All items with like grouping codes may be combined for quantity pricing.

We would like to express our appreciation to those of you who have continued to support us and offer new readers an invitation to try our parts and services. We are getting better and stronger every day.

Sincerely,

Lynette Caskey

Lynette Caskey
General Manager

ORDER DESK (TOLL FREE): 800-325-2595 & 800-325-2981
MON. – FRI. 7 AM – 9 PM SAT. 8 AM – 4 PM

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CERAMIC DISC CAPACITORS

Solid State Systems offers a complete selection of Ceramic Disc Capacitors for a wide range of applications from high voltage RF to low voltage transistor Circuitry. **PLEASE NOTE: In order to maintain our low prices, we must request that you order in exact multiples of 10 per item; you may, however, mix all different types of ceramic capacitors for quantity pricing.**

Sprague type 5HK ceramic disc capacitors offer high capacity in a minimum space. All type 5HK capacitors have a tolerance of -20%, +80%. Voltage rating is 1000WVDC for values up to and including 0.01μF; and 500WVDC for 0.015μF and higher.

Catalog Number	Capacitance	10-90	100-240	250-490	500-990	1000 -up	Grouping Code
72-10369	1000 pF	.10	.09	.08	.07	.06	4
72-15369	1500 pF	.10	.09	.08	.07	.06	4
72-20369	2000 pF	.10	.09	.08	.07	.06	4
72-22369	2200 pF	.10	.09	.08	.07	.06	4
72-33369	3300 pF	.10	.09	.08	.07	.06	4
72-47369	4700 pF	.10	.09	.08	.07	.06	4
72-50369	5000 pF	.10	.09	.08	.07	.06	4
72-68369	6800 pF	.10	.09	.08	.07	.06	4
72-10469	0.010 μF	.10	.09	.08	.07	.06	4
72-15463	0.015 μF	.10	.09	.08	.07	.06	4
72-20463	0.020 μF	.11	.10	.09	.08	.07	4
72-25463	0.025 μF	.11	.10	.09	.08	.07	4
72-40463	0.040 μF	.20	.18	.16	.14	.12	4
72-50463	0.050 μF	.20	.18	.16	.14	.12	4
72-10563	0.1 μF	.35	.32	.29	.26	.23	4

Sprague type TG low voltage ceramic disc capacitors with a rating of 100WVDC are ideal for use in transistorized circuits. All units have a ±20% tolerance.

Catalog Number	Capacitance	10-90	100-240	250-490	500-990	1000 -up	Grouping Codes
73-50342	0.005 μF	.10	.09	.08	.07	.06	4
73-10442	0.01 μF	.11	.10	.09	.08	.07	4
73-20442	0.02 μF	.11	.10	.09	.08	.07	4
73-25442	0.025 μF	.12	.11	.10	.09	.08	4
73-30442	0.03 μF	.12	.11	.10	.09	.08	4
73-50442	0.05 μF	.20	.18	.16	.14	.12	4
73-10542	0.1 μF	.26	.23	.20	.17	.14	4

Centralab type UK miniature ceramic discs offer minimum space occupancy on transistorized boards where large capacitance in a small volume is required. Tolerance: 3WVDC types, guaranteed minimum value; all others -20%, +80%.

Catalog Number	Capacitance	10-90	100-240	250-490	500-990	1000 -up	Grouping Code
84-10415	.01 μF, 16V	.10	.09	.08	.07	.06	4
84-22421	.022 μF, 25V	.15	.14	.13	.11	.10	4
84-10509	.1 μF, 10V	.12	.11	.10	.09	.08	4
84-20509	.2 μF, 10V	.20	.18	.16	.14	.12	4
84-47503	.47 μF, 3V	.25	.22	.19	.16	.13	4
84-10603	1.0 μF, 3V	.25	.22	.19	.16	.13	4
84-22603	2.2 μF, 3V	.30	.27	.24	.21	.18	4

Sprague type 5GA ceramic disc capacitors have low self-inductance of silvered flat-plate design for high by-pass efficiency. All type 5GA capacitors have a tolerance of ±20%, and 1000WVDC ratings.

Catalog Number	Capacitance	10-90	100-240	250-490	500-990	1000 -up	Grouping Code
71-50069	5 pF	.10	.09	.08	.07	.06	4
71-75069	7.5 pF	.10	.09	.08	.07	.06	4
71-10169	10 pF	.10	.09	.08	.07	.06	4
71-12169	12 pF	.10	.09	.08	.07	.06	4
71-15169	15 pF	.10	.09	.08	.07	.06	4
71-20169	20 pF	.10	.09	.08	.07	.06	4
71-22169	22 pF	.10	.09	.08	.07	.06	4
71-25169	25 pF	.10	.09	.08	.07	.06	4
71-27169	27 pF	.10	.09	.08	.07	.06	4
71-30169	30 pF	.10	.09	.08	.07	.06	4
71-33169	33 pF	.10	.09	.08	.07	.06	4
71-39169	39 pF	.10	.09	.08	.07	.06	4
71-50169	50 pF	.10	.09	.08	.07	.06	4
71-56169	56 pF	.10	.09	.08	.07	.06	4
71-68169	68 pF	.10	.09	.08	.07	.06	4
71-75169	75 pF	.10	.09	.08	.07	.06	4
71-82169	82 pF	.10	.09	.08	.07	.06	4
71-10269	100 pF	.10	.09	.08	.07	.06	4
71-12269	120 pF	.10	.09	.08	.07	.06	4
71-15269	150 pF	.10	.09	.08	.07	.06	4
71-18269	180 pF	.10	.09	.08	.07	.06	4
71-20269	200 pF	.10	.09	.08	.07	.06	4
71-22269	220 pF	.10	.09	.08	.07	.06	4
71-25269	250 pF	.10	.09	.08	.07	.06	4
71-27269	270 pF	.10	.09	.08	.07	.06	4
71-30269	300 pF	.10	.09	.08	.07	.06	4
71-33269	330 pF	.10	.09	.08	.07	.06	4
71-36269	360 pF	.10	.09	.08	.07	.06	4
71-39269	390 pF	.10	.09	.08	.07	.06	4
71-47269	470 pF	.10	.09	.08	.07	.06	4
71-50269	500 pF	.10	.09	.08	.07	.06	4
71-56269	560 pF	.10	.09	.08	.07	.06	4
71-68269	680 pF	.10	.09	.08	.07	.06	4
71-75269	750 pF	.10	.09	.08	.07	.06	4
71-82269	820 pF	.10	.09	.08	.07	.06	4
71-10369	1000 pF	.10	.09	.08	.07	.06	4
71-12369	1200 pF	.10	.09	.08	.07	.06	4
71-15369	1500 pF	.10	.09	.08	.07	.06	4
71-18369	1800 pF	.10	.09	.08	.07	.06	4
71-20369	2000 pF	.10	.09	.08	.07	.06	4
71-22369	2200 pF	.10	.09	.08	.07	.06	4
71-25369	2500 pF	.10	.09	.08	.07	.06	4
71-27369	2700 pF	.10	.09	.08	.07	.06	4
71-30369	3000 pF	.10	.09	.08	.07	.06	4
71-33369	3300 pF	.10	.09	.08	.07	.06	4
71-39369	3900 pF	.10	.09	.08	.07	.06	4
71-47369	4700 pF	.10	.09	.08	.07	.06	4
71-50369	5000 pF	.10	.09	.08	.07	.06	4
71-10469	0.01 μF	.11	.10	.09	.08	.07	4
71-20469	0.02 μF	.12	.11	.10	.09	.08	4

SOLID STATE SYSTEMS, INC. P.O. BOX 773 COLUMBIA, MISSOURI 65201

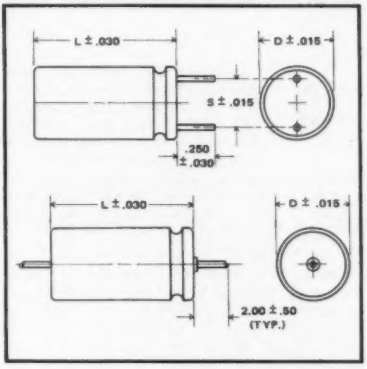
ELECTROLYTIC CAPACITORS

These aluminum electrolytic capacitors offer an unexcelled combination of high performance, high stability, low leakage current and long shelf life in a package ideally suited for operation in coupling, by-passing and filtering functions with typical operating life of 10 years.

PLEASE NOTE: In order to keep our costs at minimum and maintain our low prices, we must request that you order in EXACT multiples of 10 per item. However, you may mix all electrolytic capacitors for quantity pricing.

- ★ Operating Temperature Range: -30°C to +85°C.
- ★ Maximum DC Working Voltage: Rated for continuous duty at 85°C.
- ★ Capacitance Tolerance Measured at 120 Hz and 25°C Ambient Temperature: -10%, +100%.
- ★ Maximum Leakage Current: According to formula:

  $1\ (\mu A) = 0.02 \times C \cdot V$.
- ★ Lead Pull Test: Units will withstand steady pull of 5 lbs. (2.5 lbs. for radial leads) applied to the lead, axially, for a period of 5 minutes.
- ★ Life Test: After 1000 hours at rated voltage and temperature of 85°C, the capacitance will be no less than 85% nor more than 120% of the initial value and leakage current will not exceed the maximum given above.



PHYSICAL DIMENSIONS & PRICE LISTING

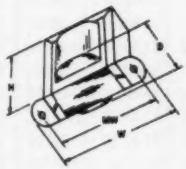
AXIAL LEADS				RADIAL LEADS					Capacitance	Working DC	Surge DC	PRICE EACH					
Catalog Number	Dimensions "D"	"L"	Lead Dia.	Catalog Number	Dimensions "D"	"L"	"S"	Lead Dia.	μFd	Volts	Volts	10-90	100-240	250-490	500-990	1000-up	Grouping Code
37-10609	.205	0.488	.020	38-10609	.205	0.413	.079	.020	1	10	13	.10	.09	.08	.07	.06	5
37-10621	.205	0.488	.020	38-10621	.205	0.413	.079	.020	1	25	32	.11	.10	.09	.08	.07	5
37-10633	.205	0.488	.020	38-10633	.205	0.413	.079	.020	1	50	63	.12	.11	.10	.09	.08	5
37-22609	.205	0.488	.020	38-22609	.205	0.413	.079	.020	2.2	10	13	.10	.09	.08	.07	.06	5
37-22621	.205	0.488	.020	38-22621	.205	0.413	.079	.020	2.2	25	32	.11	.10	.09	.08	.07	5
37-22633	.244	0.492	.024	38-22633	.244	0.417	.098	.020	2.2	50	63	.12	.11	.10	.09	.08	5
37-33609	.205	0.488	.020	38-33609	.205	0.413	.079	.020	3.3	10	13	.10	.09	.08	.07	.06	5
37-33621	.205	0.488	.020	38-33621	.205	0.413	.079	.020	3.3	25	32	.11	.10	.09	.08	.07	5
37-33633	.244	0.492	.024	38-33633	.283	0.417	.098	.020	3.3	50	63	.12	.11	.10	.09	.08	5
37-47609	.205	0.488	.020	38-47609	.205	0.413	.079	.020	4.7	10	13	.10	.09	.08	.07	.06	5
37-47621	.205	0.488	.020	38-47621	.205	0.413	.079	.020	4.7	25	32	.11	.10	.09	.08	.07	5
37-47633	.323	0.622	.024	38-47633	.283	0.417	.098	.020	4.7	50	63	.12	.11	.10	.09	.08	5
37-10709	.205	0.488	.020	38-10709	.205	0.413	.079	.020	10	10	13	.10	.09	.08	.07	.06	5
37-10721	.244	0.492	.024	38-10721	.244	0.417	.098	.020	10	25	32	.11	.10	.09	.08	.07	5
37-10733	.323	0.622	.024	38-10733	.323	0.512	.138	.020	10	50	63	.12	.11	.10	.09	.08	5
37-22709	.244	0.492	.024	38-22709	.244	0.417	.098	.020	22	10	13	.10	.09	.08	.07	.06	5
37-22721	.323	0.622	.024	38-22721	.323	0.520	.118	.020	22	25	32	.13	.12	.11	.10	.09	5
37-22733	.402	1.024	.024	38-22733	.402	0.768	.197	.024	22	50	63	.18	.17	.16	.15	.14	5
37-33709	.244	0.492	.024	38-33709	.244	0.417	.098	.020	33	10	13	.10	.09	.08	.07	.06	5
37-33721	.323	0.622	.024	38-33721	.323	0.520	.118	.020	33	25	32	.13	.12	.11	.10	.09	5
37-33733	.402	1.024	.024	38-33733	.402	0.787	.197	.024	33	50	63	.20	.19	.17	.16	.14	5
37-47709	.323	0.622	.024	38-47709	.323	0.417	.138	.020	47	10	13	.11	.10	.09	.08	.07	5

SOLID STATE SYSTEMS, INC. P.O. BOX 773 COLUMBIA, MISSOURI 65201

AXIAL LEADS				RADIAL LEADS					Capacitance	Working DC	Surge DC	PRICE EACH					
Catalog Number	Dimensions "D"	"L"	Lead Dia.	Catalog Number	Dimensions "D"	"L"	"S"	Lead Dia.	μFd	Volts	Volts	10-90	100-240	250-490	500-990	1000-up	Grouping Code
37-47721	.402	1.004	.024	38-47721	.402	0.512	.197	.020	47	25	32	.15	.14	.13	.12	.11	5
37-47733	.520	1.240	.031	38-47733	.520	0.807	.236	.024	47	50	63	.19	.18	.17	.16	.14	5
37-10809	.323	0.622	.024	38-10809	.323	0.512	.138	.020	100	10	13	.12	.11	.10	.09	.08	5
37-10821	.402	1.004	.024	38-10821	.402	0.787	.197	.024	100	25	32	.18	.17	.16	.15	.14	5
37-10833	.520	1.240	.031	38-10833	.520	1.240	.236	.031	100	50	63	.27	.25	.23	.21	.18	5
37-15809	.402	1.004	.024	38-15809	.402	0.524	.197	.020	150	10	13	.17	.16	.15	.14	.13	5
37-15821	.402	1.024	.024	38-15821	.520	0.787	.236	.024	150	25	32	.24	.23	.21	.20	.18	5
37-15833	.638	1.260	.031	38-15833	.638	1.260	.295	.031	150	50	63	.36	.34	.32	.30	28	5
37-22809	.402	1.004	.024	38-22809	.402	0.571	.197	.024	220	10	13	.13	.12	.11	.10	.09	5
37-22821	.520	1.240	.031	38-22821	.520	0.807	.236	.024	220	25	32	.25	.24	.22	.21	.19	5
37-22833	.717	1.240	.031	38-22833	.638	1.555	.295	.031	220	50	63	.37	.35	.32	.30	.27	5
37-33809	.402	1.004	.024	38-33809	.402	0.768	.197	.024	330	10	13	.20	.19	.18	.17	.16	5
37-33821	.520	1.240	.031	38-33821	.520	1.240	.236	.031	330	25	32	.26	.24	.22	.20	.18	5
37-33833	.717	1.811	.031	38-33833	.717	1.772	.295	.031	330	50	63	.54	.50	.46	.42	.38	5
37-47809	.402	1.004	.024	38-47809	.402	0.768	.197	.024	470	10	13	.24	.23	.21	.20	.18	5
37-47815	.520	1.240	.031	38-47815	.520	0.984	.236	.031	470	16	20	.25	.24	.22	.21	.19	5
37-47821	.638	1.240	.031	38-47821	.630	0.984	.295	.031	470	25	32	.26	.24	.22	.20	.18	5
37-47827	.717	1.240	.031	38-47827	.638	1.555	.295	.031	470	35	44	.35	.33	.31	.29	.27	5
37-47833	.717	1.949	.031	38-47833	.717	1.909	.295	.031	470	50	63	.64	.60	.55	.51	.46	5
37-68809	.520	1.240	.031	38-68809	.520	1.004	.236	.031	680	10	13	.31	.29	.27	.25	.23	5
37-68821	.717	1.260	.031	38-68821	.638	1.575	.295	.031	680	25	32	.42	.39	.36	.33	.30	5
37-10909	.520	1.240	.031	38-10909	.638	1.004	.295	.031	1000	10	13	.41	.38	.35	.32	.29	5
37-10915	.638	1.240	.031	38-10915	.638	1.260	.295	.031	1000	16	20	.45	.42	.39	.36	.33	5
37-10921	.717	1.437	.031	38-10921	.717	1.398	.295	.031	1000	25	32	.50	.47	.43	.40	.37	5
37-10927	.717	1.949	.031	38-10927	.717	1.969	.295	.031	1000	35	44	.67	.63	.58	.54	.49	5
37-15915	.717	1.457	.031	38-15915	.638	1.575	.295	.031	1500	16	20	.42	.39	.36	.33	.30	5
37-22915	.717	1.594	.031	38-22915	.717	1.752	.295	.031	2200	16	20	.56	.53	.49	.46	.42	5

TRANSFORMERS

Three Stancor filament transformers are now available for a variety of power supply circuit applications. All three have 117 volts, 50/60 Hz primaries and center-tapped secondaries with lead terminations. All secondary voltages ±3%. Units designed and built to meet the requirements of EIA for electrical tolerances, dielectric strength, temperature rise and construction. All are insulated with class A materials; (105°C maximum operating temperatures).



DIMENSIONS & PRICE LISTING

Catalog Number	Stancor Part Number	Secondary Volts	Secondary Amps	Dimensions H	W	D	MW	Wt. Lbs.	1-49	50-99	100-499	500-999	1000-up	Grouping Code
11-06134	P-6134	6.3	1.2	1 5/8	2 7/8	1 7/8	2 3/8	0.8	3.00	2.75	2.50	2.00	1.50	7
11-08384	P-8384	12.6	1.0	2	3 1/4	1 3/4	2 13/16	0.9	3.25	3.00	2.75	2.25	1.75	7
11-08180	P-8180	25.2	1.0	2	3 1/4	2 1/8	2 13/16	1.4	3.25	3.00	2.75	2.25	1.75	7

SOLID STATE SYSTEMS, INC. P.O. BOX 773 COLUMBIA, MISSOURI 65201

RESISTORS

Solid State Systems presents standard 5% and 10% tolerance Stackpole & Allen-Bradley type RCR hot molded fixed composition resistors which meet all requirements of MIL-R-39008. These resistors have established reliability to 0.001% failure rate per 1000 hours of operation at maximum ambient temperature of 70°C as symbolized by the fifth color band on the body of the resistor.

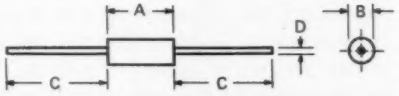
- ★ Maximum Ambient Operating Temperature: 70°C.
- ★ Available Values: All 84 standard 10%, and all 167 standard 5% values from 2.7Ω to 22MΩ.
- ★ Unexcelled low noise characteristics.
- ★ Utmost uniformity in dimensions due to exclusive molding process.
- ★ All leads tin plated to meet MIL-STD-202, Method 208 requirements.
- ★ Permanent color codes which are immune to scrubbing with all commercially used flux solvents.

Within the limitations shown in price table below, all values of ¼ and ½ watt resistors may be combined for quantity pricing. **All Resistors must be ordered in exact multiples of 5 per value.**

COLOR	FIRST DIGIT	SEDOND DIGIT	MULTI-PLIER	TOLERANCE	RELIABILITY LEVEL*
Silver	--	--	--------	±10%	-------
Gold	--	--	0.1	±5%	-------
Black	0	0	1	----	-------
Brown	1	1	10	----	1%
Red	2	2	100	----	0.1%
Orange	3	3	1,000	----	0.01%
Yellow	4	4	10,000	----	0.001%
Green	5	5	100,000	----	-------
Blue	6	6	1,000,000	----	-------
Violet	7	7	--------	----	-------
Gray	8	8	--------	----	-------
White	9	9	--------	----	-------

* **RELIABILITY LEVEL:** Percent failure per 1000 hrs.

Catalog Number	Multiples of 5 Per Value		Multiples of 50 Per Value	Multiples of 1000 Per Value		Grouping Code
	5 & up	50-950	1000 & up	1000-9000	10,000 & up	
From Table I	.05	.040	.035	.03	.025	3
From Table II	.08	.065	.055	.045	.040	3



Wattage	Dimension In Inches			
	A	B	C	D
¼	0.250±0.015	0.090±0.008	1.500±0.125	0.025±0.002
½	0.375±0.031	0.140±0.008	1.500±0.125	0.033±0.002

TABLE I: STANDARD 10% VALUES AND CATALOG NUMBERS

Resistance	Catalog Number ¼ Watt	Catalog Number ½ Watt	Resistance	Catalog Number ¼ Watt	Catalog Number ½ Watt	Resistance	Catalog Number ¼ Watt	Catalog Number ½ Watt	Resistance	Catalog Number ¼ Watt	Catalog Number ½ Watt
			100	11-10207	12-10220	10K	11-10407	12-10420	1.0M	11-10607	12-10620
			120	11-12207	12-12220	12K	11-12407	12-12420	1.2M	11-12607	12-12620
			150	11-15207	12-15220	15K	11-15407	12-15420	1.5M	11-15607	12-15620
			180	11-18207	12-18220	18K	11-18407	12-18420	1.8M	11-18607	12-18620
			220	11-22207	12-22220	22K	11-22407	12-22420	2.2M	11-22607	12-22620
2.7	11-27007	12-27020	270	11-27207	12-27220	27K	11-27407	12-27420	2.7M	11-27607	12-27620
3.3	11-33007	12-33020	330	11-33207	12-33220	33K	11-33407	12-33420	3.3M	11-33607	12-33620
3.9	11-39007	12-39020	390	11-39207	12-39220	39K	11-39407	12-39420	3.9M	11-39607	12-39620
4.7	11-47007	12-47020	470	11-47207	12-47220	47K	11-47407	12-47420	4.7M	11-47607	12-47620
5.6	11-56007	12-56020	560	11-56207	12-56220	56K	11-56407	12-56420	5.6M	11-56607	12-56620
6.8	11-68007	12-68020	680	11-68207	12-68220	68K	11-68407	12-68420	6.8M	11-68607	12-68620
8.2	11-82007	12-82020	820	11-82207	12-82220	82K	11-82407	12-82420	8.2M	11-82607	12-82620
10	11-10107	12-10120	1000	11-10307	12-10320	100K	11-10507	12-10520	10M	11-10707	12-10720
12	11-12107	12-12120	1200	11-12307	12-12320	120K	11-12507	12-12520	12M	11-12707	12-12720
15	11-15107	12-15120	1500	11-15307	12-15320	150K	11-15507	12-15520	15M	11-15707	12-15720
18	11-18107	12-18120	1800	11-18307	12-18320	180K	11-18507	12-18520	18M	11-18707	12-18720
22	11-22107	12-22120	2200	11-22307	12-22320	220K	11-22507	12-22520	22M	11-22707	12-22720
27	11-27107	12-27120	2700	11-27307	12-27320	270K	11-27507	12-27520			
33	11-33107	12-33120	3300	11-33307	12-33320	330K	11-33507	12-33520			
39	11-39107	12-39120	3900	11-39307	12-39320	390K	11-39507	12-39520			
47	11-47107	12-47120	4700	11-47307	12-47320	470K	11-47507	12-47520			
56	11-56107	12-56120	5600	11-56307	12-56320	560K	11-56507	12-56520			
68	11-68107	12-68120	6800	11-68307	12-68320	680K	11-68507	12-68520			
82	11-82107	12-82120	8200	11-82307	12-82320	820K	11-82507	12-82520			

SOLID STATE SYSTEMS, INC. P.O. BOX 773 COLUMBIA, MISSOURI 65201

TABLE II: STANDARD 5% VALUES AND CATALOG NUMBERS

Resistance	Catalog Number ¼ Watt	Catalog Number ½ Watt	Resistance	Catalog Number ¼ Watt	Catalog Number ½ Watt	Resistance	Catalog Number ¼ Watt	Catalog Number ½ Watt	Resistance	Catalog Number ¼ Watt	Catalog Number ½ Watt
			100	13-10207	14-10220	10K	13-10407	14-10420	1.0M	13-10607	14-10620
			110	13-11207	14-11220	11K	13-11407	14-11420	1.1M	13-11607	14-11620
			120	13-12207	14-12220	12K	13-12407	14-12420	1.2M	13-12607	14-12620
			130	13-13207	14-13220	13K	13-13407	14-13420	1.3M	13-13607	14-13620
			150	13-15207	14-15220	15K	13-15407	14-15420	1.5M	13-15607	14-15620
			160	13-16207	14-16220	16K	13-16407	14-16420	1.6M	13-16607	14-16620
			180	13-18207	14-18220	18K	13-18407	14-18420	1.8M	13-18607	14-18620
			200	13-20207	14-20220	20K	13-20407	14-20420	2.0M	13-20607	14-20620
			220	13-22207	14-22220	22K	13-22407	14-22420	2.2M	13-22607	14-22620
			240	13-24207	14-24220	24K	13-24407	14-24420	2.4M	13-24607	14-24620
2.7	13-27007	14-27020	270	13-27207	14-27220	27K	13-27407	14-27420	2.7M	13-27607	14-27620
3.0	13-30007	14-30020	300	13-30207	14-30220	30K	13-30407	14-30420	3.0M	13-30607	14-30620
3.3	13-33007	14-33020	330	13-33207	14-33220	33K	13-33407	14-33420	3.3M	13-33607	14-33620
3.6	13-36007	14-36020	360	13-36207	14-36220	36K	13-36407	14-36420	3.6M	13-36607	14-36620
3.9	13-39007	14-39020	390	13-39207	14-39220	39K	13-39407	14-39420	3.9M	13-39607	14-39620
4.3	13-43007	14-43020	430	13-43207	14-43220	43K	13-43407	14-43420	4.3M	13-43607	14-43620
4.7	13-47007	14-47020	470	13-47207	14-47220	47K	13-47407	14-47420	4.7M	13-47607	14-47620
5.1	13-51007	14-51020	510	13-51207	14-51220	51K	13-51407	14-51420	5.1M	13-51607	14-51620
5.6	13-56007	14-56020	560	13-56207	14-56220	56K	13-56407	14-56420	5.6M	13-56607	14-56620
6.2	13-62007	14-62020	620	13-62207	14-62220	62K	13-62407	14-62420	6.2M	13-62607	14-62620
6.8	13-68007	14-68020	680	13-68207	14-68220	68K	13-68407	14-68420	6.8M	13-68607	14-68620
7.5	13-75007	14-75020	750	13-75207	14-75220	75K	13-75407	14-75420	7.5M	13-75607	14-75620
8.2	13-82007	14-82020	820	13-82207	14-82220	82K	13-82407	14-82420	8.2M	13-82607	14-82620
9.1	13-91007	14-91020	910	13-91207	14-91220	91K	13-91407	14-91420	9.1M	13-91607	14-91620
10	13-10107	14-10120	1000	13-10307	14-10320	100K	13-10507	14-10520	10M	13-10707	14-10720
11	13-11107	14-11120	1100	13-11307	14-11320	110K	13-11507	14-11520	11M	13-11707	14-11720
12	13-12107	14-12120	1200	13-12307	14-12320	120K	13-12507	14-12520	12M	13-12707	14-12720
13	13-13107	14-13120	1300	13-13307	14-13320	130K	13-13507	14-13520	13M	13-13707	14-13720
15	13-15107	14-15120	1500	13-15307	14-15320	150K	13-15507	14-15520	15M	13-15707	14-15720
16	13-16107	14-16120	1600	13-16307	14-16320	160K	13-16507	14-16520	16M	13-16707	14-16720
18	13-18107	14-18120	1800	13-18307	14-18320	180K	13-18507	14-18520	18M	13-18707	14-18720
20	13-20107	14-20120	2000	13-20307	14-20320	200K	13-20507	14-20520	20M	13-20707	14-20720
22	13-22107	14-22120	2200	13-22307	14-22320	220K	13-22507	14-22520	22M	13-22707	14-22720
24	13-24107	14-24120	2400	13-24307	14-24320	240K	13-24507	14-24520			
27	13-27107	14-27120	2700	13-27307	14-27320	270K	13-27507	14-27520			
30	13-30107	14-30120	3000	13-30307	14-30320	300K	13-30507	14-30520			
33	13-33107	14-33120	3300	13-33307	14-33320	330K	13-33507	14-33520			
36	13-36107	14-36120	3600	13-36307	14-36320	360K	13-36507	14-36520			
39	13-39107	14-39120	3900	13-39307	14-39320	390K	13-39507	14-39520			
43	13-43107	14-43120	4300	13-43307	14-43320	430K	13-43507	14-43520			
47	13-47107	14-47120	4700	13-47307	14-47320	470K	13-47507	14-47520			
51	13-51107	14-51120	5100	13-51307	14-51320	510K	13-51507	14-51520			
56	13-56107	14-56120	5600	13-56307	14-56320	560K	13-56507	14-56520			
62	13-62107	14-62120	6200	13-62307	14-62320	620K	13-62507	14-62520			
68	13-68107	14-68120	6800	13-68307	14-68320	680K	13-68507	14-68520			
75	13-75107	14-75120	7500	13-75307	14-75320	750K	13-75507	14-75520			
82	13-82107	14-82120	8200	13-82307	14-82320	820K	13-82507	14-82520			
91	13-91107	14-91120	9100	13-91307	14-91320	910K	13-91507	14-91520			

SOLID STATE SYSTEMS, INC. P. O. BOX 773 COLUMBIA, MISSOURI 65201

DUAL-IN-LINE IC SOCKETS

Solid State Systems now offers you the most complete line of Dual-In-Line integrated circuit sockets from such leaders as Cambion®, and Micro Plastic, Inc. Virtually every combination of Tin or Gold plated, Solder or Wire-Wrap type in both glass-filled Nylon or Diallylptalate for IC's from 6– to 40–pins is now available from a single source. As it is our policy, you may of course, combine different sockets with the same grouping code to obtain quantity pricing.

SOCKET SPECIFICATIONS:

Sockets keyed "Diallyl" in table on following page have body material of fiberglass-reinforced Diallylptalate usable over –50°C to 125°C temperature range. Sockets keyed "Nylon" have body material of glass-reinforced Nylon usable over 0°C to 75°C temperature range.

All contact materials are phosphor bronze. All tin plated pins have a minimum of 300 micro-inches of electro deposited tin and all gold plated pins have a minimum of 20 micro-inches of hard gold over nickel or copper.

Sockets starting with catalog numbers 31- are high density type mountable on 0.1" separation, all others must have 0.2" separation between adjacent sockets. All sockets have built-in closed-entry caps except types starting with catalog numbers 31-. Separate nylon closed-entry caps for these are available as listed below:

Catalog Number	Number of Pins	Color	Unit Price			Grouping Code
			5-95	100-995	1000-up	
31-03014	14	Black	.05	.04	.03	8
31-03016	16	White	.05	.04	.03	8

PLEASE NOTE: Figures 1-10 below provide physical dimensions for available sockets. When selecting socket to fit your specifications, consult column labled *FIGURES* at top of table on following page.

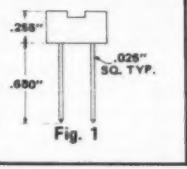


Fig. 1

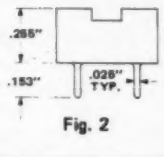


Fig. 2

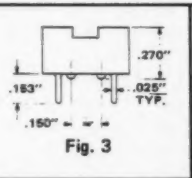


Fig. 3

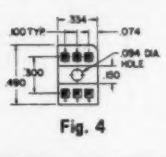


Fig. 4

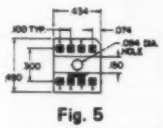


Fig. 5

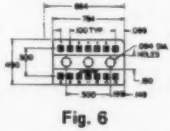


Fig. 6

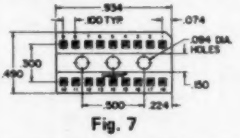


Fig. 7

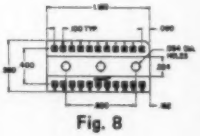


Fig. 8

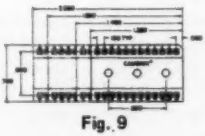


Fig. 9

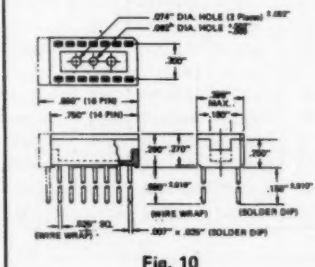


Fig. 10

SOLID STATE SYSTEMS, INC.
P.O. BOX 773
COLUMBIA, MISSOURI 65201

PLEASE NOTE: Due to our method of packaging, all sockets must be ordered in *multiples of 5 per item.*

Catalog Number	Number of Pins	Color	Pin Plating	Material	Type	Figures	Unit Price					Grouping Code
							5-45	50-95	100-495	500-995	1000-up	
41-37714	6	Blue	Tin	Diallyl	Solder-Tab	2, 4	.29	.26	.22	.19	.16	6
41-37713	6	Blue	Gold	Diallyl	Solder-Tab	2, 4	.32	.28	.24	.21	.17	6
41-38814	6	Blue	Tin	Diallyl	Wire-Wrap	1, 4	.34	.30	.26	.23	.19	6
41-38813	6	Blue	Gold	Diallyl	Wire-Wrap	1, 4	.37	.33	.28	.24	.20	6
41-37724	8	Blue	Tin	Diallyl	Solder-Tab	2, 5	.32	.28	.24	.21	.17	6
41-37723	8	Blue	Gold	Diallyl	Solder-Tab	2, 5	.34	.30	.26	.23	.19	6
41-38824	8	Blue	Tin	Diallyl	Wire-Wrap	1, 5	.29	.26	.22	.19	.16	6
41-38823	8	Blue	Gold	Diallyl	Wire-Wrap	1, 5	.32	.28	.24	.21	.17	6
41-37774	14	Red	Tin	Nylon	Solder-Tab	3, 6	.32	.28	.24	.21	.17	6
41-37773	14	Red	Gold	Nylon	Solder-Tab	3, 6	.37	.33	.28	.24	.20	6
31-01014	14	Black	Gold	Nylon	Solder-Tab	10	.43	.38	.33	.28	.23	6
41-37884	14	Blue	Tin	Diallyl	Solder-Tab	2, 6	.52	.46	.40	.34	.28	6
41-37883	14	Blue	Gold	Diallyl	Solder-Tab	2, 6	.60	.53	.46	.40	.33	6
31-02014	14	Black	Gold	Nylon	Wire-Wrap	10	.53	.47	.41	.35	.29	6
41-38974	14	Blue	Tin	Diallyl	Wire-Wrap	1, 6	.52	.46	.40	.34	.28	6
41-38973	14	Blue	Gold	Diallyl	Wire-Wrap	1, 6	.55	.49	.42	.36	.30	6
41-37784	16	Red	Tin	Nylon	Solder-Tab	3, 6	.34	.30	.26	.23	.19	6
41-37783	16	Red	Gold	Nylon	Solder-Tab	3, 6	.41	.36	.31	.27	.22	6
31-01016	16	White	Gold	Nylon	Solder-Tab	10	.49	.43	.37	.32	.26	6
41-37894	16	Blue	Tin	Diallyl	Solder-Tab	2, 6	.52	.46	.40	.34	.28	6
41-37893	16	Blue	Gold	Diallyl	Solder-Tab	2, 6	.60	.53	.46	.40	.33	6
31-02016	16	White	Gold	Nylon	Wire-Wrap	10	.58	.52	.45	.38	.32	6
41-38984	16	Blue	Tin	Diallyl	Wire-Wrap	1, 6	.55	.49	.42	.36	.30	6
41-38983	16	Blue	Gold	Diallyl	Wire-Wrap	1, 6	.60	.53	.46	.40	.33	6
41-37874	18	Blue	Tin	Diallyl	Solder-Tab	2, 7	.60	.53	.46	.40	.33	6
41-37873	18	Blue	Gold	Diallyl	Solder-Tab	2, 7	.65	.58	.50	.43	.35	6
41-38954	18	Blue	Tin	Diallyl	Wire-Wrap	1, 7	.81	.72	.62	.53	.44	6
41-38953	18	Blue	Gold	Diallyl	Wire-Wrap	1, 7	.94	.83	.72	.62	.51	6
41-37854	22	Blue	Tin	Diallyl	Solder-Tab	2, 8	.65	.58	.50	.43	.35	6
41-37853	22	Blue	Gold	Diallyl	Solder-Tab	2, 8	.71	.63	.54	.46	.38	6
41-38924	22	Blue	Tin	Diallyl	Wire-Wrap	1, 8	1.17	1.04	.90	.77	.63	6
41-38923	22	Blue	Gold	Diallyl	Wire-Wrap	1, 8	1.30	1.15	1.00	.85	.70	6
41-51534	24	Red	Tin	Nylon	Solder-Tab	3, 9	1.25	1.11	.96	.82	.68	6
41-51533	24	Red	Gold	Nylon	Solder-Tab	3, 9	1.38	1.22	1.06	.91	.75	6
41-37904	24	Blue	Tin	Diallyl	Solder-Tab	2, 9	1.25	1.11	.96	.82	.68	6
41-37903	24	Blue	Gold	Diallyl	Solder-Tab	2, 9	1.38	1.22	1.06	.91	.75	6
41-38964	24	Blue	Tin	Diallyl	Wire-Wrap	1, 9	1.33	1.18	1.02	.87	.72	6
41-38963	24	Blue	Gold	Diallyl	Wire-Wrap	1, 9	1.46	1.29	1.12	.96	.79	6
41-37834	28	Blue	Tin	Diallyl	Solder-Tab	2, 9	1.98	1.75	1.52	1.30	1.07	6
41-37833	28	Blue	Gold	Diallyl	Solder-Tab	2, 9	2.27	2.01	1.74	1.48	1.22	6
41-38904	28	Blue	Tin	Diallyl	Wire-Wrap	1, 9	1.43	1.27	1.10	.94	.77	6
41-38903	28	Blue	Gold	Diallyl	Wire-Wrap	1, 9	1.56	1.38	1.20	1.02	.84	6
41-37914	36	Blue	Tin	Diallyl	Solder-Tab	2, 9	2.21	1.96	1.70	1.45	1.19	6
41-37913	36	Blue	Gold	Diallyl	Solder-Tab	2, 9	2.47	2.19	1.90	1.62	1.33	6
41-38934	36	Blue	Tin	Diallyl	Wire-Wrap	1, 9	2.21	1.96	1.70	1.45	1.19	6
41-38933	36	Blue	Gold	Diallyl	Wire-Wrap	1, 9	2.47	2.19	1.90	1.62	1.33	6
41-37664	40	Blue	Tin	Diallyl	Solder-Tab	2, 9	1.20	1.06	.92	.79	.65	6
41-37663	40	Blue	Gold	Diallyl	Solder-Tab	2, 9	1.30	1.15	1.00	.85	.70	6
41-38854	40	Blue	Tin	Diallyl	Wire-Wrap	1, 9	1.20	1.06	.92	.79	.65	6
41-38853	40	Blue	Gold	Diallyl	Wire-Wrap	1, 9	1.30	1.15	1.00	.85	.70	6

SOLID STATE SYSTEMS, INC. P.O. BOX 773 COLUMBIA, MISSOURI 65201

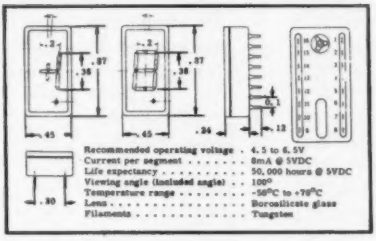
READOUTS

A wide choice of 7-segment and ±1 overflow Incandescent and LED Readouts are now available from Solid State Systems for practically any type of application. PLEASE NOTE: All displays may be combined for quantity pricing.

INCANDESCENT DISPLAYS

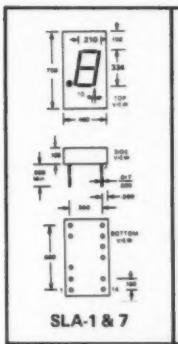
The Series 90 MINITRON® readout is a miniature direct viewed incandescent filament display, housed in a standard metal 16–pin dual-in-line package with a hermetically sealed front lens. These units operate from 5 volt TTL supply and are fully compatible with TTL decoder driver, 7447, without the need for any external current limiting resistors. The current drain at 5VDC is only 8mA per segment with a design life of 50,000 hours. Due to white-light characteristics of this display, filtering by means of virtually any color is possible without sacrificing sharpness of the character displayed.

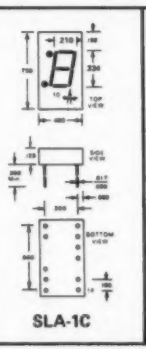
SEE NEXT PAGE FOR PRICING INFORMATION

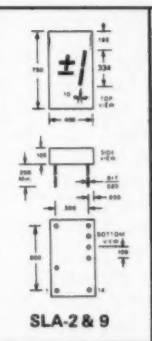

Recommended operating voltage . 4.5 to 6.5V
Current per segment . . . . . 8mA @ 5VDC
Life expectancy . . . . . 50,000 hours @ 5VDC
Viewing angle (included angle) . . 100°
Temperature range . . . . . -55°C to +75°C
Lens . . . . . Borosilicate glass
Filaments . . . . . Tungsten

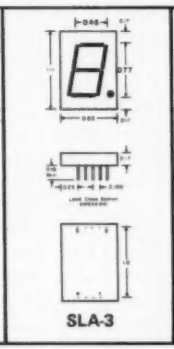
LED DISPLAYS

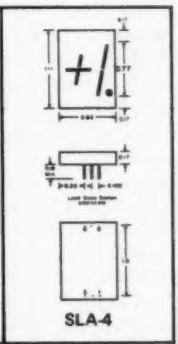
Figures 1 through 8 below provide physical characteristics of all LED displays. Optical and Electrical characteristics are listed for all LED's on following page as is pricing information on all displays.

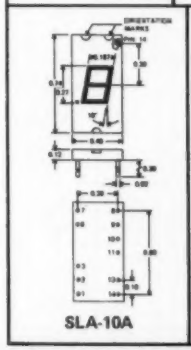

SLA-1 & 7

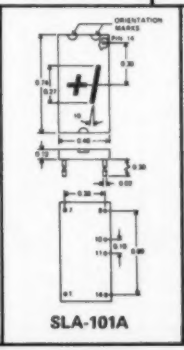

SLA-1C

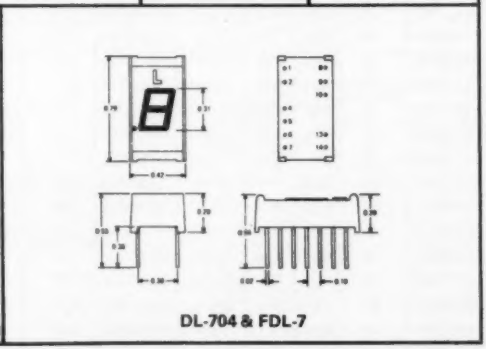

SLA-2 & 9


SLA-3


SLA-4


SLA-10A


SLA-101A


DL-704 & FDL-7

SOLID STATE SYSTEMS, INC. P.O. BOX 773 COLUMBIA, MISSOURI 65201

ABSOLUTE MAXIMUM RATINGS

	SLA-1	SLA-1C	SLA-2	SLA-3	SLA-4	SLA-7	SLA-9	DL-10A	DL-101A	DL-704	FDL-7	UNITS
Power dissipation at 25°C ambient	750	750	500	1750	900	750	500	650	650	500	500	mW
Derating factor above 25°C	10	10	6.5	23	12	12.5	10	10	10	6.6	6.6	mW/°C
Peak inverse voltage per segment	5.5	5.5	5.5	9.0	9.0	3.0	3.0	6.0	6.0	3.0	3.0	volts
Peak inverse voltage per decimal point	5.5	5.5	—	4.0	4.0	3.0	—	3.0	—	3.0	3.0	volts
Continuous forward current per segment or decimal point	40	40	40	45	45	40	40	25	25	30	30	mA
Storage and operating temperature:												
(Min.)	-55	-55	-55	-40	-40	-40	-40	-55	-55	-20	-20	°C
(Max.)	100	100	100	100	100	85	85	100	100	100	100	

TYPICAL OPTICAL CHARACTERISTICS PER SEGMENT OR DECIMAL POINT AT 25°C

Luminous intensity at:	1.0	1.0	1.0	3.0	3.0	0.3	0.3	—	—	0.7	1.4	mcd
I_F=	15	15	15	30	30	20	20	—	—	10	20	mA
Peak emission wavelength	690	690	690	690	690	690	690	660	660	660	700	nm
Spectral line half-width	85	85	85	85	85	85	85	40	40	40	40	nm
Rise and fall time	450	450	450	450	450	450	450	400	400	400	400	nsec.

TYPICAL ELECTRICAL CHARACTERISTICS PER SEGMENT OR DECIMAL POINT AT 25°C

Forward voltage per segment at:	2.1	2.1	2.1	4.7	4.7	2.2	2.2	3.4	3.4	1.7	1.7	volts
I_F=	15	15	15	30	30	20	20	20	20	20	20	mA
Forward voltage per decimal point at:	2.1	2.1	—	2.3	2.3	2.2	—	1.6	—	1.7	1.7	volts
I_F=	15	15	—	30	30	20	—	20	—	20	20	mA
Maximum reverse current per segment at:	50	50	50	50	50	100	100	100	100	100	100	μA
V_R=	5.5	5.5	5.5	9.0	9.0	3.0	3.0	6.0	6.0	3.0	3.0	volts
Maximum reverse current per decimal point at:	50	50	—	50	50	100	—	100	—	100	100	μA
V_R=	5.5	5.5	—	4.0	4.0	3.0	—	3.0	—	3.0	3.0	volts
Capacitance at 0 volts, 1 MHz	100	100	100	50	50	100	100	80	80	120	120	pF
Recommended current limiting resistors for operation with 7447 and TTL supply:												
Segment	150	150	150	2.7	2.7	120	120	68	68	390	150	Ω
Decimal Point	150	150	—	82	82	120	—	150	—	390	150	Ω

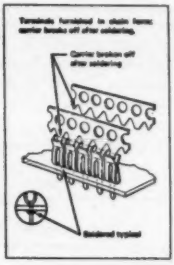
PRICE LISTING FOR ALL DISPLAYS

Catalog Number	Description	1-49	50-99	100-499	500-999	1000-up	Grouping Code
21-00001	Opcon SLA-1, 7-segment LED display	4.50	4.25	3.75	3.40	3.00	10
11-48001	Pkg. of 8 current limiting resistors for SLA-1	.36	.32	.28	.24	.20	16
23-00011	Opcon SLA-1C, 7-segment LED display W/colon	4.75	4.50	4.00	3.65	3.25	10
11-49011	Pkg. of 9 current limiting resistors for SLA-1C	.40	.36	.32	.28	.24	16
24-00002	Opcon SLA-2, ±1 LED display	4.50	4.25	3.75	3.40	3.00	10
11-44002	Pkg. of 4 current limiting resistors for SLA-2	.20	.17	.14	.12	.10	16
21-00003	Opcon SLA-3, 7-segment LED display	7.75	7.50	7.00	6.75	6.50	10
11-48003	Pkg. of 8 current limiting resistors for SLA-3	.36	.32	.28	.24	.20	16
24-00004	Opcon SLA-4, ±1 LED display	7.75	7.50	7.00	6.75	6.50	10
11-45004	Pkg. of 5 current limiting resistors for SLA-4	.24	.21	.18	.15	.12	16
21-00007	Opcon SLA-7, 7-segment LED display	3.50	3.25	3.00	2.75	2.50	10
11-48007	Pkg. of 8 current limiting resistors for SLA-7	.36	.32	.28	.24	.20	16
24-00009	Opcon SLA-9, ±1 LED display	3.50	3.25	3.00	2.75	2.50	10
11-44009	Pkg. of 4 current limiting resistors for SLA-9	.20	.17	.14	.12	.10	16
16-00010	Litronix DL-10A, 7-segment LED display	4.95	4.75	4.50	4.25	4.00	10
11-48010	Pkg. of 8 current limiting resistors for DL-10A	.36	.32	.28	.24	.20	16
16-00101	Litronix DL-101A, ±1 LED display	4.95	4.75	4.50	4.25	4.00	10
11-48101	Pkg. of 4 current limiting resistors for DL-101A	.20	.17	.14	.12	.10	16
16-00704	Litronix DL-704, 7-segment LED display	2.50	2.25	2.00	1.75	1.50	10
11-48704	Pkg. of 8 current limiting resistors for DL-704	.36	.32	.28	.24	.20	16
16-00007	Litronix FDL-7, 7-segment LED display	3.25	3.00	2.75	2.50	2.25	10
11-48007	Pkg. of 8 current limiting resistors for FDL-7	.36	.32	.28	.24	.20	16
39-00760	Luminetics, 7-segment incandescent display	3.00	2.75	2.50	2.25	1.90	10
39-00160	Luminetics, ±1 incandescent display	3.00	2.75	2.50	2.25	1.90	10

SOLID STATE SYSTEMS, INC.
P.O. BOX 773
COLUMBIA, MISSOURI 65201

MOLEX IC TERMINALS

Molex Solidercon ® terminals provide the advantage of plug-in packages for connecting integrated circuits. Model 1938-4 terminals accept IC pins .007/.011" x .018/.030". Rises .180" above the board. Terminals are made of Tin-plated brass .100" on centers; and require .200" between rows. TERMINALS ARE SOLD IN MULTIPLES OF 100 ONLY.



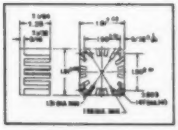
Please order by Catalog Number 33-19384 (Grouping Code = 11):

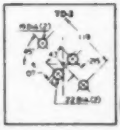
100 for $1.00	300 for $2.60	500 for $4.20	700 for $5.80	900 for $7.40
200 for $1.80	400 for $3.40	600 for $5.00	800 for $6.60	1,000 for $8.20

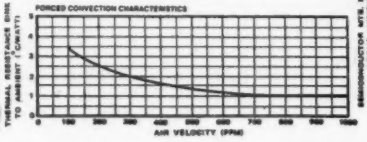
Each additional 1,000 ..... $7.50/M
Reel of 25,000 ..... $150.00
Reel of 50,000 ..... $275.00

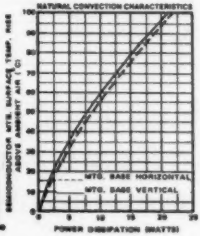
HEAT SINKS

Wakefield series 680 Heat Sink will provide optimum natural convection cooling per unit volume occupied above the circuit board. It permits free circulation of air from any direction, so mounting in any position is possible. This Heat Sink is pre-drilled to accept TO–3 packages. Material is 1100 aluminum per Mil-A-12545 and is black anodized per Mil-A-8625 Type II.





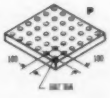


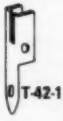


Catalog Number	Description	1-49	50-99	100-499	500-999	1000-up	Grouping Code
11-68012	PC Board Type Heat Sink	1.20	1.10	1.00	.90	.80	12

VECTORBOARDS® & VECTORPINS®

"P" Pattern Micro-Vectorboard ® mounts integrated circuits with 0.100" x 0.100" hole spacing. Material is G-10 epoxy glass board per Mil-P-18177 type GEE and measures 17" x 4–1/2" x 1/16". Holes are 0.042" in diameter. Unit accepts all 6– through 40– pin IC sockets listed on pages 6 and 7. In addition, terminals listed below may also be inserted in the boards for mounting of discrete components and providing test points.





Type T-42-1 terminal is mainly for mounting of components such as resistors, diodes, transistors, etc. The main slot holds 3 or 4 .025" diameter wires.

Type K-32, J-pin when used in conjunction with T-42-1, provides .025" square tail for wire-wrapping applications.

The new type T-49 terminal combines the advantages of a .025" square wrap post, 9/16" long with a clip action upper end which will hold leads from 0.010" to 0.040".

Catalog Number	Description	1-24	25-49	50-99	100-249	250-up	Grouping Code
22-44062	Type 169P44-062 Vectorboard	4.25	4.00	3.75	3.50	3.25	9
22-01421	Pkg. of 100 Type T-42-1 Terminals	1.80	1.60	1.40	1.20	1.00	14
22-10421	Pkg. of 1000 Type T-42-1 Terminals	11.70	11.20	10.70	10.20	9.70	14
22-01032	Pkg. of 100 Type K-32 Pins	1.90	1.70	1.50	1.30	1.10	14
22-10032	Pkg. of 1000 Type K-32 Pins	12.60	12.10	11.60	11.10	10.60	14
22-01049	Pkg. of 100 Type T-49 Terminals	2.50	2.30	2.10	1.90	1.70	14
22-10049	Pkg. of 1000 Type T-49 Terminals	21.00	20.00	19.00	18.00	16.00	14
22-00149	P-149 Insertion Tool for T-42-1	2.20					15
22-00156	P-156 Insertion Tool for T-49	4.50					15

SOLID STATE SYSTEMS, INC. P.O. BOX 773 COLUMBIA, MISSOURI 65201

INTEGRATED CIRCUITS & DIODES

		Any Quantity Per Item (Mix)			*Multiples of 10 Per Item (Mix)*		
Catalog Number	**Description**	**1-99**	**100-999**	**1000 Up**	**100-990**	**1000-9990**	**Grouping Code**
7400	Quad 2-Input Pos. NAND Gate	.34	.32	.30	.28	.26	1
7401	Quad 2-Input Pos. NAND Gate with O/C Outputs	.34	.32	.30	.28	.26	1
7402	Quad 2-Input Pos. NOR Gate	.34	.32	.30	.28	.26	1
7403	Quad 2-Input Pos. NAND Gate with O/C Outputs	.34	.32	.30	.28	.26	1
7404	Hex Inverter	.36	.34	.32	.30	.28	1
7405	Hex Inverter with O/C Outputs	.36	.34	.32	.30	.28	1
7406	Hex Inverter Buffer/Driver with O/C 30V Outputs	.56	.53	.50	.47	.44	1
7407	Hex Buffer/Driver with O/C 30V Outputs	.56	.53	.50	.47	.44	1
7408	Quad 2-Input Pos. AND Gate	.38	.36	.34	.32	.30	1
7409	Quad 2-Input AND Gate with O/C Outputs	.38	.36	.34	.32	.30	1
7410	Triple 3-Input Pos. NAND Gate	.34	.32	.30	.28	.26	1
7411	Triple 3-Input Pos. AND Gate	.34	.32	.30	.28	.26	1
7413	Dual NAND Schmitt Trigger	.60	.57	.54	.51	.48	1
7416	Hex Inverter Buffer/Driver with O/C 15V Outputs	.54	.51	.48	.45	.42	1
7417	Hex Buffer/Driver with O/C 15V Outputs	.54	.51	.48	.45	.42	1
7418	Triple 3-Input OR Gate	.38	.36	.34	.32	.30	1
7420	Dual 4-Input Pos. NAND Gate	.34	.32	.30	.28	.26	1
7421	Dual 4-Input Pos. AND Gate	.34	.32	.30	.28	.26	1
7423	Expandable Dual 4-Input Pos. NOR Gate W/Strobe	.84	.80	.76	.72	.68	1
7425	Dual 4-Input Pos. NOR Gate	.54	.51	.48	.45	.42	1
7426	Quad 2-Input High Voltage NAND Gate	.40	.37	.34	.31	.28	1
7430	8-Input Pos. NAND Gate	.34	.32	.30	.28	.26	1
7437	Quad 2-Input Pos. NAND Buffer	.56	.53	.50	.47	.44	1
7438	Quad 2-Input Pos. NAND Buffer with O/C Outputs	.56	.53	.50	.47	.44	1
7440	Dual 4-Input Pos. NAND Buffer	.34	.32	.30	.28	.26	1
7441	BCD-To-Decimal Decoder/Driver	1.73	1.64	1.55	1.46	1.37	1
7442	BCD-To-Decimal Decoder	1.34	1.27	1.20	1.13	1.06	1
7443	Excess-3-To-Decimal Decoder	1.34	1.27	1.20	1.13	1.06	1
7444	Excess-3-Gray-To-Decimal Decoder	1.34	1.27	1.20	1.13	1.06	1
7445	BCD-To-Decimal Dec./Dr. with O/C HV Outputs	1.71	1.62	1.53	1.44	1.35	1
7446	BCD-To-Seven-Segment Decoder/Driver, 30V Outputs	1.34	1.27	1.20	1.13	1.06	1
7447	BCD-To-Seven-Segment Decoder/Driver, 15V Outputs	1.30	1.23	1.16	1.09	1.02	1
7448	BCD-To-Seven-Segment Decoder/Driver	1.44	1.37	1.29	1.22	1.14	1
7450	Exp. Dual 2-Wide 2-Input AND-OR-INVERT Gate	.34	.32	.30	.28	.26	1
7451	Dual 2-Wide 2-Input AND-OR-INVERT Gate	.34	.32	.30	.28	.26	1
7453	Exp. 4-Wide 2-Input AND-OR-INVERT Gate	.34	.32	.30	.28	.26	1
7454	4-Wide 2-Input AND-OR-INVERT Gate	.34	.32	.30	.28	.26	1
7459	Dual 2-Wide 2-3-Input AND-OR-INVERT Gate	.34	.32	.30	.28	.26	1
7460	Dual 4-Input Expander	.34	.32	.30	.28	.26	1
7470	Gated J-K Flip-Flop	.46	.43	.40	.37	.34	1
7472	J-K Master-Slave Flip-Flop	.40	.38	.36	.34	.32	1
7473	Dual J-K Master-Slave Flip-Flop	.52	.49	.46	.43	.40	1

Catalog Number	Description	Any Quantity Per Item (Mix) 1-99	100-999	1000 Up	Multiples of 10 Per Item (Mix) 100-990	1000-9990	Grouping Code
7474	Dual D-Type Edge-Triggered Flip-Flop	.52	.49	.46	.43	.40	1
7475	Quadruple Bistable Latch	.80	.76	.72	.68	.64	1
7476	Dual J-K Master-Slave Flip-Flop W/Preset & Clear	.58	.55	.52	.49	.46	1
7480	Gated Full Adder	.80	.76	.72	.68	.64	1
7482	2-Bit Binary Full Adder	1.10	1.05	1.00	.95	.90	1
7483	4-Bit Binary Full Adder (Look Ahead Carry)	1.72	1.64	1.56	1.48	1.40	1
7485	4-Bit Magnitude Comparator	1.58	1.51	1.44	1.37	1.30	1
7486	Quad 2-Input Exclusive-OR Gate	.60	.57	.54	.51	.48	1
7489	(8225) 64-Bit Random Access Memory	5.00	4.75	4.50	4.25	4.00	1
7490	Decade Counter	.85	.80	.75	.70	.65	1
7491	8-Bit Shift Register	1.48	1.41	1.34	1.27	1.20	1
7492	Divide-By-Twelve Counter	.85	.80	.75	.70	.65	1
7493	4-Bit Binary Counter	.85	.80	.75	.70	.65	1
7494	4-Bit Shift Register (Parallel-In, Serial-Out)	1.32	1.26	1.20	1.14	1.08	1
7495	4-Bit Right-Shift Left-Shift Register	1.32	1.26	1.20	1.14	1.08	1
7496	5-Bit Shift Register	1.32	1.26	1.20	1.14	1.08	1
74100	Dual 4-Bit Bistable Latch	1.80	1.70	1.60	1.50	1.40	1
74104	Gated J-K Master-Slave Flip-Flop	.70	.67	.64	.61	.58	1
74105	Gated J-K Master-Slave Flip-Flop	.70	.67	.64	.61	.58	1
74107	Dual J-K Master-Slave Flip-Flop	.54	.51	.48	.45	.42	1
74121	Monostable Multivibrator	.60	.57	.54	.51	.48	1
74122	Retriggerable Monostable Multivibrator W/Clear	.74	.71	.68	.65	.62	1
74123	Dual Retriggerable Monostable Multivibrator W/Clear	1.30	1.20	1.10	1.00	.90	1
74141	BCD-To-Decimal Decoder/Driver	1.75	1.66	1.57	1.48	1.39	1
74145	BCD-To-Decimal Dec./Dr. with O/C HV Outputs	1.50	1.43	1.36	1.29	1.22	1
74150	16-Line–To–1-Line Data Selector/Multiplexer	2.00	1.85	1.70	1.55	1.40	1
74151	8-Line–To–1-Line Data Selector/Multiplexer	1.30	1.24	1.18	1.12	1.06	1
74153	Dual 4-Line–To–1-Line Data Selector/Multiplexer	1.70	1.60	1.50	1.40	1.30	1
74154	4-Line–To–16-Line Decoder/Demultiplexer	2.75	2.55	2.35	2.05	1.85	1
74155	Dual 2-Line–To–4-Line Decoder/Demultiplexer	1.56	1.49	1.42	1.35	1.28	1
74156	Dual 2-Line–To–4-Line Decoder/Demultiplexer	1.46	1.39	1.31	1.23	1.16	1
74157	Quad 2-Input Data Selector/Multiplexer	1.56	1.48	1.39	1.31	1.23	1
74158	Quad 2-Input Data Selector/Multiplexer with O/C	1.56	1.48	1.39	1.31	1.23	1
74160	Synch. 4-Bit Decade Counter W/Asynch. Clear	1.56	1.48	1.39	1.31	1.23	1
74161	Synch. 4-Bit Binary Counter W/Asynch. Clear	2.10	2.00	1.90	1.80	1.70	1
74162	Synch. 4-Bit Decade Counter W/Synch. Clear	2.10	2.00	1.90	1.80	1.70	1
74163	Synch. 4-Bit Binary Counter W/Synch. Clear	2.10	2.00	1.90	1.80	1.70	1
74164	8-Bit Shift Register (Serial-In, Parallel-Out)	2.10	2.00	1.90	1.80	1.70	1
74165	8-Bit Shift Register (Parallel-/Serial-In, Serial-Out)	2.96	2.82	2.67	2.52	2.37	1
74166	8-Bit Shift Register (Parallel-/Serial-In, Serial-Out)	2.20	2.09	1.98	1.87	1.76	1
74180	8-Bit Odd/Even Parity Generator/Checker	1.30	1.23	1.16	1.09	1.02	1
74181	High Speed Arithmetic/Logic Unit	5.20	4.90	4.60	4.30	4.00	1
74182	Look-Ahead Carry Generator	1.26	1.19	1.12	1.05	.98	1
74192	Presettable Synch. Decade Up/Down Counter	2.10	2.00	1.90	1.80	1.70	1
74193	Presettable Synch. 4-Bit Binary Up/Down Counter	2.10	2.00	1.90	1.80	1.70	1
74198	8-Bit Shift Register	3.10	2.95	2.80	2.65	2.50	1
74199	8-Bit Shift Register	3.10	2.95	2.80	2.65	2.50	1

SOLID STATE SYSTEMS, INC. P.O. BOX 773 COLUMBIA, MISSOURI 65201

SOLID STATE SYSTEMS, INC.

ORDER BLANK

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SCHOTTKY TTL

Catalog Number	Description	Any Quantity Per Item (Mix) 1-99	100-999	1000 Up	Multiples of 10 Per Item (Mix) 100-990	1000-9990	Grouping Code
74S00	Quad 2-Input Pos. NAND Gate	.88	.84	.79	.75	.70	1
74S01	Quad 2-Input Pos. NAND Gate with O/C Outputs	.88	.84	.79	.75	.70	1
74S02	Quad 2-Input Pos. NOR Gate	.88	.84	.79	.75	.70	1
74S03	Quad 2-Input Pos. NAND Gate with O/C Outputs	.88	.84	.79	.75	.70	1
74S04	Hex Inverter	1.00	.95	.90	.85	.80	1
74S05	Hex Inverter with O/C Outputs	1.00	.95	.90	.85	.80	1
74S08	Quad 2-Input Pos. AND Gate	.88	.84	.79	.75	.70	1
74S09	Quad 2-Input AND Gate with O/C Outputs	.88	.84	.79	.75	.70	1
74S10	Triple 3-Input Pos. NAND Gate	.88	.84	.79	.75	.70	1
74S11	Triple 3-Input Pos. AND Gate	.88	.84	.79	.75	.70	1
74S15	Triple 3-Input Pos. AND with O/C Outputs	.88	.84	.79	.75	.70	1
74S20	Dual 4-Input Pos. NAND Gate	.88	.84	.79	.75	.70	1
74S21	Dual 4-Input Pos. AND Gate	.88	.84	.79	.75	.70	1
74S22	Dual 4-Input Pos. NAND Gate with O/C Outputs	.88	.84	.79	.75	.70	1
74S40	Dual 4-Input Pos. NAND Buffer	1.00	.95	.90	.85	.80	1
74S50	Exp. Dual 2-Wide 2-Input AND-OR-INVERT Gate	.88	.84	.79	.75	.70	1
74S51	Dual 2-Wide 2-Input AND-OR-INVERT Gate	.88	.84	.79	.75	.70	1
74S60	Dual 4-Input Expander	.88	.84	.79	.75	.70	1
74S64	4-2-3-2-Input AND-OR-INVERT Gate	.88	.84	.79	.75	.70	1
74S65	4-2-3-2-Input AND-OR-INVERT Gate with O/C Outputs	.88	.84	.79	.75	.70	1
74S73	Dual J-K Master-Slave Flip-Flop	1.82	1.73	1.63	1.54	1.44	1
74S74	Dual D-Type Edge-Triggered Flip-Flop	1.82	1.73	1.63	1.54	1.44	1
74S76	Dual J-K Master-Slave Flip-Flop W/Preset & Clear	1.82	1.73	1.63	1.54	1.44	1
74S78	Dual J-K Master-Slave Flip-Flop W/Preset & Clear	1.82	1.73	1.63	1.54	1.44	1
74S107	Dual J-K Master-Slave Flip-Flop	1.82	1.73	1.63	1.54	1.44	1
74S112	Dual J-K Edge-Trig. F-F W/Sep. Clock & Clear	1.82	1.73	1.63	1.54	1.44	1
74S113	Dual J-K Edge-Trig. F-F W/Sep. Clock	1.82	1.73	1.63	1.54	1.44	1
74S114	Dual J-K Edge-Trig. F-F W/Common Clock & Clear	1.82	1.73	1.63	1.54	1.44	1
74S140	Dual 4-Input Pos. NAND Buffer/Line Driver	1.00	.95	.90	.85	.80	1

LINEAR IC'S

NE501A	Video Amplifier	2.99	2.82	2.66	2.49	2.32	1
NE526A	Analog Voltage Comparator	3.59	3.38	3.17	2.95	2.74	1
NE531V	High Slew-Rate Operational Amplifier	3.20	3.04	2.88	2.72	2.56	1
NE536T	FET Input Operational Amplifier	7.31	6.88	6.45	6.02	5.59	1
NE540L	Power Driver	2.16	2.04	1.92	1.80	1.68	1
SE540L	Power Driver	4.48	4.20	3.92	3.64	3.36	1
NE550A	Precision Voltage Regulator	1.30	1.23	1.16	1.09	1.02	1
NE555V	Timer	1.10	1.05	1.00	.95	.90	1
NE560B	Phase Locked Loop	3.57	3.36	3.15	2.94	2.73	1
NE561B	Phase Locked Loop	3.57	3.36	3.15	2.94	2.73	1
NE562B	Phase Locked Loop	3.57	3.36	3.15	2.94	2.73	1
NE565A	Phase Locked Loop	3.57	3.36	3.15	2.94	2.73	1
NE566V	Function Generator	3.57	3.36	3.15	2.94	2.73	1

SOLID STATE SYSTEMS, INC. P.O. BOX 773 COLUMBIA, MISSOURI 65201

Catalog Number	Description	Any Quantity Per Item (Mix) 1-99	100-999	1000 Up	Multiples of 10 Per Item (Mix) 100-990	1000-9990	Grouping Code
NE567V	Tone Decoder Phase Locked Loop	3.57	3.36	3.15	2.94	2.73	1
N5111A	(ULN7111) FM Detector and Limiter	.90	.86	.82	.78	.74	1
N5556V	Operational Amplifier	2.10	1.95	1.80	1.65	1.50	1
N5558V	Dual Operational Amplifier	1.00	.95	.90	.85	.80	1
N5596A	Balanced Modulator-Demodulator	1.87	1.77	1.66	1.56	1.46	1
μA709CV	Operational Amplifier	.50	.47	.44	.41	.38	1
μA710CA	Differential Voltage Comparator	.50	.47	.44	.41	.38	1
μA711CA	Dual Voltage Comparator	.55	.52	.49	.46	.43	1
μA723CA	Precision Voltage Regulator	1.00	.95	.90	.85	.80	1
μA733CA	Differential Video Amplifier	1.90	1.80	1.70	1.60	1.50	1
μA741CV	High Performance Operational Amplifier	.80	.75	.70	.65	.60	1
μA747CA	Dual Operational Amplifier	1.10	1.04	.98	.92	.86	1
μA748CV	High Performance Operational Amplifier	.80	.75	.70	.65	.60	1
LM335	5V, 600 mA Voltage Regulator	2.85	2.7	2.64	2.55	2.46	1
LM336	12V, 500 mA Voltage Regulator	3.85	3.66	3.46	3.27	3.06	1
LM337	15V, 450 mA Voltage Regulator	4.05	3.70	3.51	3.31	3.12	1

DIODES

1N270	Germanium Switching Diode	.15	.14	.13	.12	.11	2
1N4001	1 Amp, 50 PRV Rectifier Diode	.10	.09	.08	.07	.06	2
1N4002	1 Amp, 100 PRV Rectifier Diode	.11	.10	.09	.08	.07	2
1N4003	1 Amp, 200 PRV Rectifier Diode	.13	.12	.11	.10	.09	2
1N4004	1 Amp, 400 PRV Rectifier Diode	.14	.13	.12	.11	.10	2
1N4005	1 Amp, 600 PRV Rectifier Diode	.15	.14	.13	.12	.11	2
1N4006	1 Amp, 800 PRV Rectifier Diode	.17	.16	.14	.13	.12	2
1N4007	1 Amp, 1000 PRV Rectifier Diode	.20	.18	.16	.14	.12	2
1N4148	Silicon Switching Diode	.10	.09	.08	.07	.06	2
1N746A	3.3V, 400 mW Zener Diode	.25	.22	.19	.16	.13	2
1N747A	3.6V, 400 mW Zener Diode	.25	.22	.19	.16	.13	2
1N748A	3.9V, 400 mW Zener Diode	.25	.22	.19	.16	.13	2
1N749A	4.3V, 400 mW Zener Diode	.25	.22	.19	.16	.13	2
1N750A	4.7V, 400 mW Zener Diode	.25	.22	.19	.16	.13	2
1N751A	5.1V, 400 mW Zener Diode	.25	.22	.19	.16	.13	2
1N752A	5.6V, 400 mW Zener Diode	.25	.22	.19	.16	.13	2
1N753A	6.2V, 400 mW Zener Diode	.25	.22	.19	.16	.13	2
1N754A	6.8V, 400 mW Zener Diode	.25	.22	.19	.16	.13	2
1N755A	7.5V, 400 mW Zener Diode	.25	.22	.19	.16	.13	2
1N756A	8.2V, 400 mW Zener Diode	.25	.22	.19	.16	.13	2
1N757A	9.1V, 400 mW Zener Diode	.25	.22	.19	.16	.13	2
1N758A	10V, 400 mW Zener Diode	.25	.22	.19	.16	.13	2
1N759A	12V, 400 mW Zener Diode	.25	.22	.19	.16	.13	2

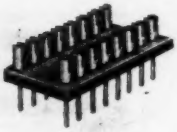
All IC's are supplied in 8–, 14–, 16–, or 24–pin DIP (Dual-in-line) plastic or ceramic package except for NE536, NE540 and SE540, which come in TO–5 package. Voltage Regulators LM335, LM336, and LM337 are supplied in TO–3 (Diamond) package.

We give FREE data sheets upon request, so ask for those data sheets that you NEED, even for those listed IC's that you are not buying.

SOLID STATE SYSTEMS, INC. P.O. BOX 773 COLUMBIA, MISSOURI 65201

IC INTERFACE HARDWARE

COMPONENT SOCKET ADAPTERS



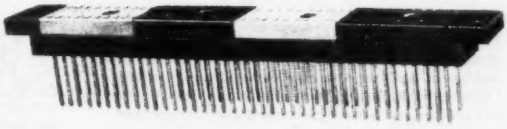
Cambion Component Socket Adapters provide versatility of component pluging for your discretes. Two models are available for both 14– and 16–pin sockets.

IC INSERTION–EXTRACTION TOOL

This handy tool properly positions the integrated circuit for insertion or extraction. Securely grips IC between the leads and under the body with clothespin-like action. Practically any dual in-line IC with 14 or 16 leads aligned on .300" centers can easily be inserted or extracted regardless of tight packaging and without damage to the fragile IC leads.

INTEGRATED SOCKET STRIP

Cambion's Integrated Socket Strips provide high density packaging of dual-in-line integrated circuits. The Integrated Socket has 0.025" tin-plated square wire-wrap pins aligned, double-column (40 pins per column), on 0.300" centers (.100" grid). As many as five dual-in-line packages can be mounted per integrated socket strip. The socket pins are replaceable, if damaged, and can be ordered separately.



BATTERY HOLDERS

Cambion's new molded battery holders offer users many advantages, not the least of which is the corrosion resistant, molded glass-filled nylon body.

Models are now available for both C size and D size batteries. They have tinned phosphor bronze contacts and built-in shock and vibration retainers which assure dependable, non-shorting service under the most severe environmental and operating conditions.

These strong individual holders interlock with each other, by a unique design, which permits building sturdy single unit assemblies for any multiple of batteries required, for either series or parallel hook-up. Truly high density packaging!

HAND WIRE–WRAPPING TOOL

Cambion's new pocket-size wire-wrapping tool is for hand wrapping No. 30 AWG wire on a .025" square wrapost. It is ideal for making field modifications, building small systems in the laboratory, teaching, for the hobbyist, and for other non-production wrapping applications.

The wrap is made by inserting pre-stripped wire in the end of the tool in either of the offset holes until the insulation comes in contact with the tool. The end of the wire is bent back, in a "V" shape to secure the wire in the tool and the insulated portion is then bent at right angles to the axis of the tool. Now the center of the tool is placed over the center of the wrapost and lowered to the level where the connection is to be made; it is turned by hand until all the stripped wire has been wrapped around the post.

A modified wrap . . . one where the insulation portion of the wire is wrapped for about one and a half turns around the post before the regular wrap . . . can be made by permitting the insulation to turn with the first one and a half turns of the tool.

Performance of wire-wrapped connections made with this tool is excellent with high strip strengths and gas tight corners achieved.

PRICE LISTING

Catalog Number	Description	1-24	25-49	50-99	100-249	250-up	Grouping Code
43-37253	14–Pin Component Adapter	1.10	1.00	.90	.80	.70	27
43-37283	16–Pin Component Adapter	1.20	1.10	1.00	.90	.80	27
43-37390	IC Insertion/Extraction Tool	1.40	1.30	1.20	1.10	1.00	27
43-28000	Molded Size "C" Battery Holder	.45	.41	.37	.33	.29	27
43-28010	Molded Size "D" Battery Holder	.45	.41	.37	.33	.29	27
43-10004	Integrated IC Socket Strip	4.75	4.50	4.00	3.75	3.50	27
43-18160	Hand Wire-Wrapping Tool	2.00	1.90	1.80	1.70	1.60	27

SOLID STATE SYSTEMS, INC.
P.O. BOX 773
COLUMBIA, MISSOURI 65201

ONE CHIP CALCULATORS & CLOCK CHIP

FEATURES

- ADD, SUBTRACT, MULTIPLY, DIVIDE
- 12 DIGIT DISPLAY AND CALCULATE
- CHAIN CALCULATIONS
- FIXED DECIMAL POINT AT 0, 2, 3, OR 4
- AUTOMATIC LOCKOUT OF "UNSURE" REPEAT OPERATION
- TRUE CREDIT BALANCE SIGN DISPLAY
- AUTOMATIC OVERFLOW INDICATION
- LEADING ZERO SUPPRESSION
- TWO PHASE CLOCK OPERATION
- 25 KHz CLOCK RATE

CT5001

- AUTOMATIC KEYBOARD DEBOUNCE
- SEVEN SEGMENT OUTPUTS
- MULTIPLEXED OUTPUTS FOR MINIMUM EXTERNAL COMPONENTS
- 12 MILLISECOND ADD/SUBTRACT AND 400 MILLISECOND MULTIPLY/DIVIDE (WORST CASE)

GENERAL DESCRIPTION

The CT5001 is a single MOS chip containing all of the logic necessary for a 12 digit calculator with display type readout. Multiplexed seven segment outputs enable operation with LED's, incandescent, and fluorescent or gas discharge tubes with a minimum of external components. The unit is packaged in a 40 lead DIP.

FUNCTIONAL DESCRIPTION

The basic arithmetic in the CT5001 is done with two - 52 bit, or 13 digit, registers. This results in capacity for 13 BCD digits of which 12 are used so that arithmetic limitations are as follows:

Number entry	12 digits
Addition, subtraction	12 digits
Multiplicand + multiplier	12 digits
Dividend	11 digits
Divisor	11 digits
Quotient + divisor	12 digits

Timing for register circulation is arranged in 13 groups of four, each one representing time for one BCD digit. At a clock rate of 25 KHz, this results in a circulation or "word time" of 2ms. As each digit is entered in BCD form from the keyboard, it is inserted via the "arithmetic unit" into the rightmost digit of the display register while previous contents are shifted one digit to the left.

Upon depression of any function key: add, subtract, multiply, divide, data representing the first operand is shifted into the non-display register. After entry of the operator or, second argument, the ‡ is used to execute = and the contents of the registers are added, subtracted, multiplied or divided so that the result is then displayed. Decimal point position is predetermined by two inputs from a four position keyboard switch. The CT5001 is available in a 40–Pin Dual-in-line package. To prevent damage to the chip due to static electricity discharge during wiring, use of a solder-tab (Catalog Number 41-37663) or wire-wrap (Catalog Number 41-38853) socket is recommended.

FEATURES

- ADD, SUBTRACT, MULTIPLY, DIVIDE
- 12 DIGIT DISPLAY AND CALCULATE
- CHAIN CALCULATIONS
- FIXED DECIMAL POINT AT 0, 1, 2, 3, 4, OR 5
- AUTOMATIC LOCKOUT OF "UNSURE" REPEAT OPERATION
- TRUE CREDIT BALANCE SIGN DISPLAY
- AUTOMATIC OVERFLOW INDICATION
- SUPPRESSION OF DISPLAY OF LEADING ZEROS
- TWO PHASE CLOCK OPERATION
- 25 KHz CLOCK RATE
- AUTOMATIC KEYBOARD DEBOUNCE
- SEVEN SEGMENT OUTPUTS

CT5005

- MULTIPLEXED INPUTS AND OUTPUTS FOR MINIMAL EXTERNAL COMPONENTS
- 12 MILLISECOND ADD/SUBTRACT AND 400 MILLISECOND MULTIPLY/DIVIDE (WORST CASE)
- STORAGE REGISTER MEMORY
- SINGLE VOLTAGE SUPPLY IS POSSIBLE
- SEGMENT AND DIGIT BLANKING FOR DISPLAY

GENERAL DESCRIPTION

The CT5005 is a single MOS chip with all the logic necessary for a twelve-digit four function calculator with an extra storage register for memory or constant application. Capability includes +, -, x, and ÷ as well as a memory register for storage of internal values or four function constant capability. Multiplexed seven segment outputs enable operation with LED, incandescent, fluorescent or gas discharge displays with a minimum of external display interface components. Feedback of timing signals through a matrix type keyboard reduces pin count to 28 as well as eliminating keyboard encoding requirements from the printed circuit board. The unit is packaged in a 28 lead DIP.

PLEASE NOTE: See following page for the CT5005 functional description. Also note pricing information for CT5001, CT5005, and CT7001 at bottom of following page.

PATENTED SOLID STATE SYSTEMS, INC. P.O. BOX 773 COLUMBIA, MISSOURI 65201

CT5005

FUNCTIONAL DESCRIPTION

In order to minimize components, the keyboard is a matrix type where the output signal which drives the digit driver signal for the display will feed back into two input lines via switch closures on keyboard. This allows capacity for twenty-four (24) keys of which twenty-one (21) are used. Circuitry for digit and segment drivers varies according to the type of display used. The CT5005 is amenable to driving most commercially available displays including LED's, gas discharge, fluorescent and incandescent displays. The only other circuit necessary is a two-phase oscillator and a power supply which again varies depending on the type display used.

Turning on power to the chip can be made to act the same as C and CM as well as setting the decimal point to position 2. This is done with a power on circuit which activates pin 18, SWON.

Note the unique method of establishing the decimal point for the fixed point calculations by simultaneous depression of the decimal point and a number key. This method saves the use of a slide switch on the keyboard and allows entry of any decimal point position up to 5 as well as clearing all registers for start of a new calculation.

Usage of the memory register can be summarized as follows:

1. To enter a number A, enter A followed by +M or -M.
2. To enter a product or quotient, execute as follows: A X B ‡ followed by +M or -M.
3. Use of +M or -M reveals the number entered in the display register. However, the number is not available for use with any other function key unless it is re-entered.
4. Following usage of +M or -M, the only valid entry is a number key or RM.
5. Use of a memory key +M, -M, RM or CM, disrupts any chain calculation in progress.
6. **Contents of the memory register are restricted to positive values.**

The memory register may also be used to contain a constant which may then be used as a factor in multiplication, division, addition or subtraction.

FEATURES

- ★ 28/30/31 DAY CALENDAR
- ★ 12/24 HOUR CLOCK AND 24 HOUR ALARM
- ★ SNOOZE ALARM
- ★ 50/60 Hz OPERATION
- ★ 6 DIGIT DISPLAY (HR., MIN., SEC.)
- ★ DIRECT DRIVE TO LED SEGMENTS
- ★ CLOCK RADIO FEATURES
- ★ ON CHIP 60 Hz BACK-UP
- ★ EASILY SETTABLE COUNTERS

CT7001

- ★ SEGMENT AND DIGIT BLANKING
- ★ SEGMENT AND DIGIT OUTPUTS CAN BE "WIRE OR'D" TO SHARE CALCULATOR DISPLAY

GENERAL DESCRIPTION

The CT7001 is an extremely versatile MOS/LSI digital clock/calendar circuit. The CT7001 has many features which may be selected by various wiring configurations of the three scanned input pins. This enables the user to easily tailor the CT7001 to his specific requirements.

Setting any counter (time, alarm, calendar, and clock radio) is quite easy since a separate control of the hour and minutes digits has been provided. The setting of any counter does not affect the contents of any other counter.

The CT7001 will accommodate either four or six standard seven segment displays. The CT7001 will direct drive the anodes of common cathode LED's. The CT7001 segment and digit outputs can be "wire OR'd" to other chips. This enables the clock to share the same displays with another chip such as a calculator.

The CT7001 can operate from either a 50/60 Hz line frequency or an external 100.8 KHz signal. If battery back-up is provided, the CT7001 will continue to operate during power outages by virtue of an on-chip 50/60 Hz backup counter. The CT7001 Digital Clock/Calendar Integrated circuit is available in 28–Pin Dual-in-line package. Due to extreme sensitivity of MOS chips to static electricity discharge, use of a 28-Pin socket, solder-tab or wire-wrap (Catalog Number 41-37833 or 41-38903), is strongly recommended.

PRICE LISTING

Catalog Number	Description	1-4	5-9	10-24	25-up	Grouping Code
63-05001	Four function calculator IC	7.50	7.00	6.00	5.50	25
63-05005	Four function calculator IC with memory	13.50	12.60	11.70	10.80	25
63-07001	Digital clock/calendar IC	13.50	12.60	11.70	10.80	25
60-05157	Set of data sheets for CT5001, CT5005 & CT7001	.50	——	——	——	26

PLEASE NOTE: Complete kits of all parts and boards for each of the above calculators and clock/calendar will be available by early December. Please write or call for further details.

SOLID STATE SYSTEMS, INC. P.O. BOX 773 COLUMBIA, MISSOURI 65201

DIGITAL TO ANALOG CONVERTERS

DESCRIPTION

The SS-2000 series of Digital to Analog Converters feature a combination of linearity, temperature stability, and settling time compatible with moderate to severe environment or rational requirements, at the lowest possible cost.

Use of stable thin film resistor networks, high quality reference devices and low drift operational amplifiers offers the user the most economical solution where reliability and long term stability are important requirements.

The SS2035, SS2135, and SS2235 are 8–, 10– and 12–bit binary D/A converters respectively; whereas SS2635 and SS2735 are 3 and 4 digit BCD D/A converters.

FEATURES

- ★ INEXPENSIVE – a significant breakthrough in price/performance ratio.
- ★ LOW LINEARITY DRIFT – 0.0005% per °C for binary and ±½ LSB for BCD converters over full operational temperature range of 0°C to +70°C.
- ★ INTERNAL/EXTERNAL REFERENCE – User selectable by jumper wire. Internal reference available for external use.
- ★ FULL SCALE AND ZERO OFFSET ADJUSTABLE – externally fine-trimable for improved accuracy.
- ★ RUGGED CONSTRUCTION – encapsulated module designed for DIP IC compatability. High quality brass, gold plated pins, 0.1" centers.

OPERATIONAL CHARACTERISTICS

SPECIFICATION	SS2035, SS2135, SS2235	SS2635	SS2735
Full Scale Output Voltage Range	0V to +10V, Straight Binary Code -5V to +5V, Offset Binary Code -10V to +10V, Offset Binary Code	0V to +9.99V, BCD Code	0V to +9.999V BCD Code
Output Impedance (DC)	< 0.1 ohm	< 0.1 ohm	< 0.1 ohm
Reference Output	+10.08V nominal at 5mA	+10.08V nominal at 5mA	-10.00V nominal at 5mA
Input Logic Levels	TTL/DTL Compatible V_H = Logical '1', +2.1V to +5.5V; V_L = Logical '0', 0V to +0.7V		
Data Loading	1 TTL Load/Line		
Temperature Range: Rated Specifications Operational Storage	0°C to +70°C -25°C to +85°C -55°C to +100°C		
Power Requirements	+15V ±5% at 30mA -15V ±5% at 20mA +5V ±5% at 80mA		
Dimensions L x W x H	2" x 2" x 0.54"	2" x 2" x 0.54"	3" x 2" x 0.54"

SPECIFICATIONS (T_A=25°C UNLESS OTHERWISE NOTED)

SPECIFICATION	SS2035	SS2135	SS2235	SS2635	SS2735
Resolution	8 Binary Bits	10 Binary Bits	12 Binary Bits	3 Digit BCD	4 Digit BCD
Setting Time (to ±0.05% of full scale, 0 to +10V)	20μS	20μS	20μS	20μS	20μS
Linearity in percent of full scale (at 25°C) (at 0°C to +70°C)	0.2 0.25	0.05 0.075	0.0125 0.0375	0.05 0.075	0.01 0.035
Zero Offset in percent of full scale	0.2	0.05	0.05	0.05	0.05
Scale Factor (Gain) Error in percent of reading	0.2	0.1	0.1	0.1	0.1
Zero Drift in percent of full scale per °C from 0°C to +70°C	0.005	0.002	0.002	0.002	0.001
Scale Factor (Gain) Drift in percent of reading per °C from 0°C to +70°C with Internal Reference with External Reference	 0.005 0.003	 0.005 0.003	 0.004 0.002	 0.004 0.002	 0.003 0.001
Output Load, rated specification (short circuit proof) R_L in KΩ C_L in pf	 >2 <1000	 >2 <1000	 >2 <1000	 >2 <1000	 >2 <1000
Long Term Stability in percent of full scale per 1000 hours per year	 0.1 0.3	 0.05 0.1	 0.05 0.1	 0.05 0.1	 0.025 0.05

SOLID STATE SYSTEMS, INC.
P.O. BOX 773
COLUMBIA, MISSOURI 65201

ANALOG TO DIGITAL CONVERTERS

DESCRIPTION

The SS-3000 series of Analog to Digital Converters are highly versatile over a wide range of applications such as Digital Panel Meters, Data Acquisition Systems, Low or High Level Transducer Readouts, and others. The BCD coded outputs of these converters makes them ideal for use when a digital readout of the analog signal is required by simple addition of necessary decoder/driver and appropriate display.

Models SS3535 and SS3635 are unipolar 2– and 3–digit A/D converters utilizing "section counting" multiple comparato: technique. Model SS3638A is a bipolar 3½ digit A/D converter with true differential input and an input impedance of 100MΩ! Separate overrange and overload bits provide for extreme simplicity in interfacing with any digital system. Models SS3735 and SS3735B are unipolar and bipolar 4–bit A/D's respectively. The principle of "section counting" is employed here again for precise conversion down to 1mV.

OPERATIONAL CHARACTERISTICS

SPECIFICATION	SS3535	SS3635	SS3638A	SS3735	SS3735B
Inputs Analog, Full Range Digital, Convert Start	0 to +9.9V Pos. Edge	0 to +9.99V Pos. Edge	±1.999V Pos. Edge	0 to +9.999V Pos. Edge	±9.999V Pos. Edge
Input Impedance R_{in} shunted by C_{in}	1MΩ 10pF	1MΩ 10pF	100MΩ 10pF	10KΩ 10pF	10KΩ 10pF
Internal Reference	10.08V (Nominal)				
Temperature Range: Rated Specification Operational Storage	0°C to +70°C -25°C to +85°C -55°C to +100°C				
Power Requirements	+15V ±5% at 60mA -15V ±5% at 24mA +5V ±5% at 200mA		+15V ±5% at 40mA -15V ±5% at 15mA +5V ±5% at 180mA	+15V ±5% at 45mA -15V ±5% at 45mA +5V ±5% at 350mA	
Dimensions L x W x H	4" x 2" x 0.54"		4" x 2" x 0.54"	3" x 2" x 0.54" (2 units)	

SPECIFICATIONS (T_A=25°C UNLESS OTHERWISE NOTED)

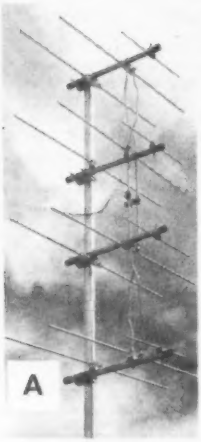
SPECIFICATION	SS3535	SS3635	SS3638A	SS3735	SS3735B
Resolution (Number of BCD Digits)	2	3	3 + Sign Bit + 100% Overrange	4	4 + Sign Bit
Coding	8–4–2–1	8–4–2–1	8–4–2–1	8–4–2–1	8–4–2–1
Conversion Time	50μSec	100μSec	10mS Full Scale 20mS Full Range	200μSec	200μSec
Linearity in percent of Full Scale (at 25°C) (0°C to +70°C)	0.5 0.5	0.05 0.075	0.03 0.05	0.01 0.035	0.01 0.035
Zero Offset in percent of Full Scale	0.5	0.05	0.05	0.05	0.05
Scale Factor (Gain) Error in percent of reading	0.5	0.1	0.1	0.1	0.1
Quantizing Error in percent of reading	0.5	0.05	0.05	0.005	0.005
Zero Drift in percent of Full Scale per °C (0°C to +70°C)	0.005	0.002	0.002	0.001	0.001
Scale Factor (Gain) Drift in percent of reading per °C (0°C to +70°C) with internal reference with external reference	0.008 0.005	0.004 0.002	0.004 0.002	0.003 0.001	0.003 0.001
Long Term Stability in percent of Full Scale: Per 1000 Hours Per Year	0.1 0.3	0.05 0.1	0.05 0.1	0.025 0.05	0.025 0.05

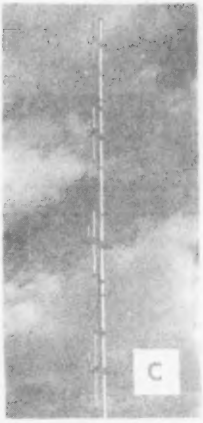
PRICE LISTING

Catalog Number	Description	1-4	5-9	10-24	25-up	Grouping Code
95-02035	Model SS2035 D/A Converter	20.75	19.75	18.75	17.75	28
95-02135	Model SS2135 D/A Converter	29.50	28.25	27.00	25.75	28
95-02235	Model SS2235 D/A Converter	45.00	43.00	41.00	39.00	28
95-02635	Model SS2635 D/A Converter	38.00	36.00	34.00	32.00	28
95-02735	Model SS2735 D/A Converter	65.00	62.00	59.00	56.00	28
95-03535	Model SS3535 A/D Converter	55.00	52.00	49.00	46.00	28
95-03635	Model SS3635 A/D Converter	100.00	96.00	92.00	88.00	28
95-13638	Model SS3638A A/D Converter	80.00	76.00	72.00	68.00	28
95-03735	Model SS3735 A/D Converter	150.00	144.00	138.00	132.00	28
95-23735	Model SS3735B A/D Converter	190.00	180.00	170.00	160.00	28

SOLID STATE SYSTEMS, INC. P.O. BOX 773 COLUMBIA, MISSOURI 65201

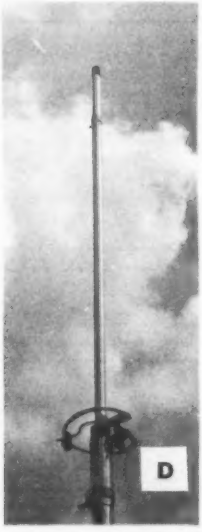
ANTENNAS





Cush Craft

2 METER FM ANTENNAS



Catalog Number	Description	Gain (dB)	F/B (dB)	Power Rating	Wt. (Lbs.)	Fig.
66-12022	**Cush-Craft DX-120, 20-Element DX Array.** Optimum front lobe, easily stacked, 52 ohm.	14.2	20	2KW	8	A
66-14722	**Cush-Craft A-147-11, 11-Element Yagi.** Standard of comparison in UHF communications.	13.2	20	1KW	6	B
66-40022	**Cush-Craft AFM-4-D, 4 Pole.** Overall length 23', 4 complete dipole assemblies on mounting booms. All hardware.	180°=9 360°=6	—	1KW	4	C
66-20022	**Cush-Craft AR-2, FM Ringo.** Ready to install up to 1¼" O.D. mast. The most popular omni-directional antenna.	3.75	—	100W	2	D
66-14422	**Cush-Craft A-147-4, 4-Element Yagi.** Rear bracket for mast or tower side mount. Boom length 44".	9	20	1KW	3	—
66-14122	**Cush-Craft AM-147-T, FM Mobile.** Professional looking fiberglass. For roof or trunk in ¾" hole with 15' RG-58/U.	3	—	100W	2	—
66-14702	**Cush-Craft A-147-22, Power Pack.** The big signal array. Two 11-element yagis and complete stacking kit.	16	24	1KW	15	—

Cush Craft

BLITZ BUG

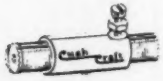
COAX LIGHTNING ARRESTER

U.S. PATENT 2,922,913

ADD UP THESE BLITZ BUG FEATURES

- ☆ Patented Static Ring
- ☆ Precision Machined
- ☆ Sealed Air Chamber
- ☆ Constant Static Drain
- ☆ Controlled Voltage
- ☆ 1 KW Power Handeling
- ☆ No Insertion Loss
- ☆ Good to 500 mc.
- ☆ Over 250,000 in use
- ☆ Matched to your equipment

lac-1



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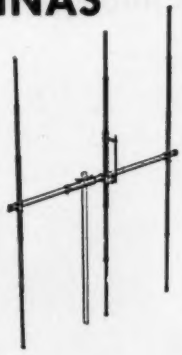
PATENTED **SOLID STATE SYSTEMS, INC.** P.O. BOX 773 COLUMBIA, MISSOURI 65201

CITIZENS BAND ANTENNAS

3 ELEMENT 8 DB GAIN

FORWARD GAIN ..... 8 db
FRONT TO BACK RATIO ..... 22 db
VSWR ..... 1 to 1
BANDWIDTH ..... 23 Channels
ELEMENT SPACING ..... Optimum
BOOM ..... 1 1/2" x 10'
ELEMENT DIAMETER ..... 3/4" - 1/2"
TURN RADIUS ..... 5'
WEIGHT ..... 10 lbs.

66-32310



RINGO

3.75 DB GAIN

- ☆ FULL HALF WAVE ANTENNA
- ☆ POWER RING TUNING
- ☆ NO DROOPING RADIALS
- ☆ BETTER RECEIVE POWER
- ☆ GOOD PORTABLE OPERATION
- ☆ RING DIAMETER 10"
- ☆ DIRECT DC GROUND
- ☆ LOW ANGLE OF RADIATION

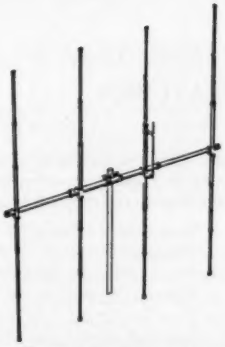
Cush Craft

66-32110

4 ELEMENT 9.5 DB GAIN

FORWARD GAIN ..... 9.5 db
FRONT TO BACK RATIO ..... 26 db
VSWR ..... 1 to 1
BANDWIDTH ..... 23 Channels
ELEMENT SPACING ..... Optimum
BOOM ..... 15/8" x 16'
ELEMENT DIAMETER ..... 3/4" - 1/2"
TURN RADIUS ..... 8'
WEIGHT ..... 14 lbs.

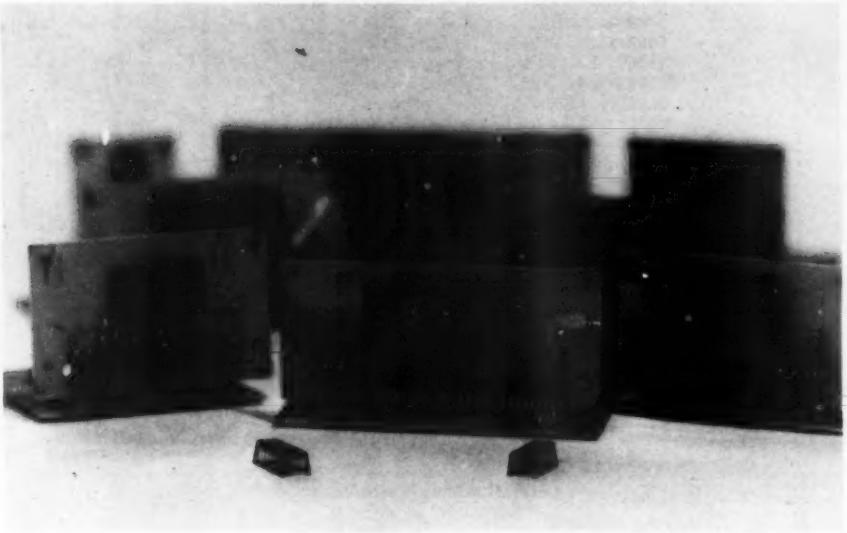
66-32410



Catalog Number	Item	1-4	5-9	10-24	25-up	Grouping Code
66-12022	Cush-Craft DX-120, 2 Meter, 20 Element	29.50	28.02	26.61	25.27	19
66-14722	Cush-Craft A-147-11, 2 Meter, 11 Element	17.95	17.05	16.19	15.38	19
66-40022	Cush-Craft AFM-4-D, 2 Meter, 4-Pole	42.50	40.37	38.35	36.43	19
66-20022	Cush-Craft AR-2, 2 Meter, FM Ringo	12.50	11.87	11.27	10.70	19
66-14422	Cush-Craft A-147-4, 2 Meter, 4-Element	9.95	9.45	8.97	8.52	19
66-14122	Cush-Craft AM-147-T, 2 Meter, Mobile	26.95	25.60	24.32	23.10	19
66-14702	Cush-Craft A-147-22, 2 Meter, Power Pak	49.50	47.02	44.66	42.42	19
66-13100	Cush-Craft LAC1 Blitz Bug	3.95	3.75	3.56	3.38	19
66-13200	Cush-Craft LAC2 Blitz Bug	4.45	4.22	4.00	3.80	19
66-32110	Cush-Craft CR-1, CB, Base Ringo	21.50	20.42	19.39	18.42	19
66-32310	Cush-Craft CB-11, CB, 3-Element	34.50	32.77	31.13	29.57	19
66-32410	Cush-Craft CB-114, CB, 4-Element	44.50	42.27	40.15	38.14	19

SOLID STATE SYSTEMS, INC.
P.O. BOX 773
COLUMBIA, MISSOURI 65201

UNIVERSAL DECADE COUNTING UNIT



FEATURES:

Fully assembled and tested Universal Decade Counting Units are now available from Solid State Systems for a variety of applications such as Pulse and Frequency Counters, Digital Clocks, Remote Displays, Time and Position Measurements and many other applications. Among features are:

- Easy to read 7-Segment LED or incandescent filament readout.
- Grouping of readouts on single board for custom designed appearance.
- LED and filament boards interchangeable.
- Readout board plugs or solders into counter/driver board for low profile.
- Your choice of 1 to 6 decades of counter/driver, latch and decoder/driver on a single PC board which plugs into edge connector with 0.156 centers.
- Tin plated, G-10, glass epoxy PC board with 2 oz. copper.
- All counter/driver boards have the following input/output leads available (as per option):

  BCD (binary coded decimal) outputs from all counting stages
  Counter reset input
  Load BCD data into counter (74192, 74196)
  Latch strobe input (7475)
  Selectable ripple blanking input/output and readout lamp test
  Selectable decimal point

- Will operate from a single 5 volt TTL compatible power supply.

SEE FOLLOWING PAGE FOR ORDERING INFORMATION AND PRICE LISTING

SOLID STATE SYSTEMS, INC. P.O. BOX 773 COLUMBIA, MISSOURI 65201

TO ORDER

PLEASE NOTE: To obtain the correct Catalog Number, replace X with the number of decades you want on the same board. For Example: 11-49202 is the correct Catalog Number for a 4-decade counter with 74192, no latch, and LED display.

Description				Catalog Number
Counter	Latch	Dec./Dr.	Display	
7490	-----	7447	Filament	11-X9001
7490	7475	7447	Filament	11-X9051
7490	-----	7447	LED	11-X9002
7490	7475	7447	LED	11-X9052
74192	-----	7447	Filament	11-X9201
74192	7475	7447	Filament	11-X9251
74192	-----	7447	LED	11-X9202
74192	7475	7447	LED	11-X9252
74196	-----	7447	Filament	11-X9601
74196	7475	7447	Filament	11-X9651
74196	-----	7447	LED	11-X9602
74196	7475	7447	LED	11-X9652

UNITS WITH 7490 COUNTER

Catalog Number	Price per Unit				Grouping Code
	1-4	5-9	10-24	25-up	
11-19001	13.00	12.50	12.00	11.50	18
11-29001	26.00	25.00	24.00	23.00	18
11-39001	39.00	37.50	36.00	34.50	18
11-49001	52.00	50.00	48.00	46.00	18
11-59001	65.00	62.50	60.00	57.50	18
11-69001	78.00	75.00	72.00	69.00	18
11-19002	15.00	14.50	14.00	13.50	18
11-29002	30.00	29.00	28.00	27.00	18
11-39002	45.00	43.50	42.00	40.50	18
11-49002	60.00	58.00	56.00	54.00	18
11-59002	75.00	72.50	70.00	67.50	18
11-69002	90.00	87.00	84.00	81.00	18
11-19051	14.25	13.75	13.25	12.75	18
11-29051	28.50	27.50	26.50	25.50	18
11-39051	42.75	41.25	39.75	38.25	18
11-49051	57.00	55.00	53.00	51.00	18
11-59051	71.25	68.75	66.25	63.75	18
11-69051	85.50	82.50	79.50	76.50	18
11-19052	16.25	15.75	15.25	14.75	18
11-29052	32.50	31.50	30.50	29.50	18
11-39052	48.75	47.25	45.75	44.25	18
11-49052	65.00	63.00	61.00	59.00	18
11-59052	81.25	78.75	76.25	73.75	18
11-69052	97.50	94.50	91.50	88.50	18

UNITS WITH 74192 COUNTER

Catalog Number	Price per Unit				Grouping Code
	1-4	5-9	10-24	25-up	
11-19201	14.00	13.50	13.00	12.50	18
11-29201	28.00	27.00	26.00	25.00	18
11-39201	42.00	40.50	39.00	37.50	18
11-49201	56.00	54.00	52.00	50.00	18
11-59201	70.00	67.50	65.00	62.50	18
11-69201	84.00	81.00	78.00	75.00	18
11-19202	16.00	15.50	15.00	14.50	18
11-29202	32.00	31.00	30.00	29.00	18
11-39202	48.00	46.50	45.00	43.50	18
11-49202	64.00	62.00	60.00	58.00	18
11-59202	80.00	77.50	75.00	72.50	18
11-69202	96.00	93.00	90.00	87.00	18
11-19251	15.25	14.75	14.25	13.75	18
11-29251	30.50	29.50	28.50	27.50	18
11-39251	45.75	44.25	42.75	41.25	18
11-49251	61.00	59.00	57.00	55.00	18
11-59251	76.25	73.75	71.25	68.75	18
11-69251	91.50	88.50	85.50	82.50	18
11-19252	17.25	16.75	16.25	15.75	18
11-29252	34.50	33.50	32.50	31.50	18
11-39252	51.75	50.25	48.75	47.25	18
11-49252	69.00	67.00	65.00	63.00	18
11-59252	86.25	83.75	81.25	78.75	18
11-69252	103.50	100.50	97.50	94.50	18

UNITS WITH 74196 COUNTER

Catalog Number	Price per Unit				Grouping Code
	1-4	5-9	10-24	25-up	
11-19601	13.75	13.25	12.75	12.25	18
11-29601	27.50	26.50	25.50	24.50	18
11-39601	41.25	39.75	38.25	36.75	18
11-49601	55.00	53.00	51.00	49.00	18
11-59601	68.75	66.25	63.75	61.25	18
11-69601	82.50	79.50	76.50	73.50	18
11-19602	15.75	15.25	14.75	14.25	18
11-29602	31.50	30.50	29.50	28.50	18
11-39602	47.25	45.75	44.25	42.75	18
11-49602	63.00	61.00	59.00	57.00	18
11-59602	78.75	76.25	73.75	71.25	18
11-69602	94.50	91.50	88.50	85.50	18
11-19651	15.00	14.50	14.00	13.50	18
11-29651	30.00	29.00	28.00	27.00	18
11-39651	45.00	43.50	42.00	40.50	18
11-49651	60.00	58.00	56.00	54.00	18
11-59651	75.00	72.50	70.00	67.50	18
11-69651	90.00	87.00	84.00	81.00	18
11-19652	17.00	16.50	16.00	15.50	18
11-29652	34.00	33.00	32.00	31.00	18
11-39652	51.00	49.50	48.00	46.50	18
11-49652	68.00	66.00	64.00	62.00	18
11-59652	85.00	82.50	80.00	77.50	18
11-69652	102.00	99.00	96.00	93.00	18

SOLID STATE SYSTEMS, INC. P.O. BOX 773 COLUMBIA, MISSOURI 65201

PUSH-BUTTON SWITCHES

DESCRIPTION

The Series LM switches are new, low-bounce miniature mechanical switches. Switching contact is achieved by moving a gold wire beam spring into the vee formed by the conical points of the two gold-plated contact rods. This contact arrangement simultaneously combines the best features and proven reliability of wiping and cross-point contact. The spring-on-spring design has the further advantage of providing the high hysteresis desired in modern keyboard switching.

These solder-mounted switches are ideal for use on circuit boards and can be wave soldered along with the other circuit components. The key/switch solder terminals are made of gold-plated beryllium copper which provides high-strength physical attachment to the board. The base of each switch contains plastic alignment studs so that no metal alignment plates are required. The complete keyboard including the printed circuit board extends only ¼ inch below the enclosure panel surface.

These reliable, low-priced units are designed for use in hand-held devices, such as miniature electronic calculators. These can be mounted on centers as close as one-half inch.

Switches with all the letters of the alphabet, numerals, and calculator functions are available. All numbers are white on black background, while others are black on white background. Letter "C" for calculators is supplied in red on black background.

SPECIFICATIONS

Electrical

Contact Form ..... SPST - N.O. momentary
Contact Rating ..... 100 ma @ 24 vdc
Contact Bounce ..... 2 milliseconds max
Operating Rate ..... > 60 cps

Mechanical

Plunger Travel ..... 0.070 ± 0.005 inch
Pre-Travel ..... 0.055 ± 0.020 inch
Key Actuation Force ..... 3.0 ± 0.5 oz std
Weight ..... 1.5 grams

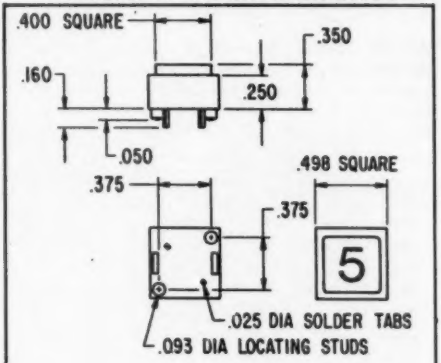
Environmental

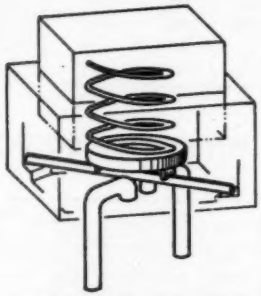
Operating Temperature ..... -10°C to +55°C
Operating Humidity ..... 0 to 98%
Storage Temperature ..... -30°C to +70°C

Life

Minimum Actuations ..... 15×10^6

PHYSICAL CHARACTERISTICS





PRICE LISTING

Catalog Number	1-49	50-99	100-499	500-999	1000-up	Grouping Code
Choose from Table Below	.45	.41	.37	.33	.29	24

LEGENDS AVAILABLE

Catalog Number	Legend	Catalog Number	Legend	Catalog Number	Legend	Catalog Number	Legend	Catalog Number	Legend	Catalog Number	Legend
65-32000	"0"	65-32101	"C"	65-32112	"RM"	65-32123	"RESET"	65-32207	"G"	65-32218	"R"
65-32001	"1"	65-32102	"CE"	65-32113	"CM"	65-32124	"STOP"	65-32208	"H"	65-32219	"S"
65-32002	"2"	65-32103	"+"	65-32114	"D"	65-32125	"RUN"	65-32209	"I"	65-32220	"T"
65-32003	"3"	65-32104	"−"	65-32115	"√X"	65-32126	"ENTER"	65-32210	"J"	65-32221	"U"
65-32004	"4"	65-32105	"X"	65-32116	"X^2"	65-32127	"AUTO"	65-32211	"K"	65-32222	"V"
65-32005	"5"	65-32106	"÷"	65-32117	"1/X"	65-32201	"A"	65-32212	"L"	65-32223	"W"
65-32006	"6"	65-32107	"="	65-32118	"π"	65-32202	"B"	65-32213	"M"	65-32224	"X"
65-32007	"7"	65-32108	"+ ="	65-32119	"%"	65-32203	"C"	65-32214	"N"	65-32225	"Y"
65-32008	"8"	65-32109	"− ="	65-32120	"ON"	65-32204	"D"	65-32215	"O"	65-32226	"Z"
65-32009	"9"	65-32110	"+M"	65-32121	"OFF"	65-32205	"E"	65-32216	"P"		
65-32100	"."	65-32111	"−M"	65-32122	"SET"	65-32206	"F"	65-32217	"Q"		

SOLID STATE SYSTEMS, INC.
P.O. BOX 773
COLUMBIA, MISSOURI 65201

ASSORTMENTS

Assortments of most wanted electronic components, Resistors and Capacitors, are now offered in counts from one each up to ten each per value. Each assortment is neatly sealed in heavy plastic with 5 and 10 count assortments already seperated by value. This should prove extremely valuable in keeping a close control over inventories. These assortments are ideal for use in R&D Laboratories, Schools and Universities, and for Experimenters. All components are brand new with full markings and per specifications listed elsewhere in this catalog.

Each assortment offers substantial savings over individual component prices; also, for the first time, all different assortments may be combined for quantity pricing.

PRICE LISTING

Catalog Number	Description	1-4	5-9	10-24	25-up	Grouping Code
15-01310	1 Each of 167 Standard 5%, ¼ Watt Resistors	12.50	12.15	11.50	10.75	17
15-02310	2 Each of 167 Standard 5%, ¼ Watt Resistors	24.00	22.75	21.50	20.50	17
15-05310	5 Each of 167 Standard 5%, ¼ Watt Resistors	54.50	51.50	48.50	45.50	17
15-10310	10 Each of 167 Standard 5%, ¼ Watt Resistors	105.50	100.25	95.00	89.75	17
15-01410	1 Each of 84 Standard 10%, ¼ Watt Resistors	4.00	3.80	3.60	3.40	17
15-02410	2 Each of 84 Standard 10%, ¼ Watt Resistors	7.50	7.13	6.75	6.38	17
15-05410	5 Each of 84 Standard 10%, ¼ Watt Resistors	17.00	16.15	15.30	14.45	17
15-10410	10 Each of 84 Standard 10%, ¼ Watt Resistors	33.00	31.35	29.70	28.05	17
15-01110	1 Each of 167 Standard 5%, ½ Watt Resistors	12.50	12.15	11.50	10.75	17
15-02110	2 Each of 167 Standard 5%, ½ Watt Resistors	24.00	22.75	21.50	20.50	17
15-05110	5 Each of 167 Standard 5%, ½ Watt Resistors	54.50	51.50	48.50	45.50	17
15-10110	10 Each of 167 Standard 5%, ½ Watt Resistors	105.50	100.25	95.00	89.75	17
15-01210	1 Each of 84 Standard 10%, ½ Watt Resistors	4.00	3.80	3.60	3.40	17
15-02210	2 Each of 84 Standard 10%, ½ Watt Resistors	7.50	7.13	6.75	6.38	17
15-05210	5 Each of 84 Standard 10%, ½ Watt Resistors	17.00	16.15	15.30	14.45	17
15-10210	10 Each of 84 Standard 10%, ½ Watt Resistors	33.00	31.35	29.70	28.05	17
15-01750	1 Each of 50 Type 5GA Ceramic Disc Capacitors	4.00	3.80	3.60	3.40	17
15-02750	2 Each of 50 Type 5GA Ceramic Disc Capacitors	7.50	7.13	6.75	6.38	17
15-05750	5 Each of 50 Type 5GA Ceramic Disc Capacitors	17.00	16.15	15.30	14.45	17
15-10750	10 Each of 50 Type 5GA Ceramic Disc Capacitors	33.00	31.35	29.70	28.05	17
15-01715	1 Each of 15 Type 5HK Ceramic Disc Capacitors	1.75	1.67	1.58	1.49	17
15-02715	2 Each of 15 Type 5HK Ceramic Disc Capacitors	3.50	3.33	3.15	2.98	17
15-05715	5 Each of 15 Type 5HK Ceramic Disc Capacitors	8.00	7.60	7.20	6.80	17
15-10715	10 Each of 15 Type 5HK Ceramic Disc Capacitors	15.00	14.25	13.50	12.75	17
15-01707	1 Each of 7 Type TG Ceramic Disc Capacitors	1.00	0.95	0.90	0.85	17
15-02707	2 Each of 7 Type TG Ceramic Disc Capacitors	1.90	1.81	1.71	1.62	17
15-05707	5 Each of 7 Type TG Ceramic Disc Capacitors	4.50	4.28	4.05	3.83	17
15-10707	10 Each of 7 Type TG Ceramic Disc Capacitors	8.50	8.08	7.65	7.23	17
15-01407	1 Each of 7 Type UK Ceramic Disc Capacitors	1.30	1.24	1.17	1.11	17
15-02407	2 Each of 7 Type UK Ceramic Disc Capacitors	2.40	2.28	2.16	2.04	17
15-05407	5 Each of 7 Type UK Ceramic Disc Capacitors	6.00	5.70	5.40	5.10	17
15-10407	10 Each of 7 Type UK Ceramic Disc Capacitors	11.00	10.45	9.90	9.35	17
15-01749	1 Each of 49 AXIAL Electrolytic Capacitors	11.00	10.50	10.00	9.50	17
15-02749	2 Each of 49 AXIAL Electrolytic Capacitors	21.00	20.00	19.00	18.00	17
15-05749	5 Each of 49 AXIAL Electrolytic Capacitors	50.00	47.00	44.00	41.00	17
15-10749	10 Each of 49 AXIAL Electrolytic Capacitors	95.00	90.00	85.00	80.00	17
15-01849	1 Each of 49 RADIAL Electrolytic Capacitors	11.00	10.50	10.00	9.50	17
15-02849	2 Each of 49 RADIAL Electrolytic Capacitors	21.00	20.00	19.00	18.00	17
15-05849	5 Each of 49 RADIAL Electrolytic Capacitors	50.00	47.00	44.00	41.00	17
15-10849	10 Each of 49 RADIAL Electrolytic Capacitors	95.00	90.00	85.00	80.00	17

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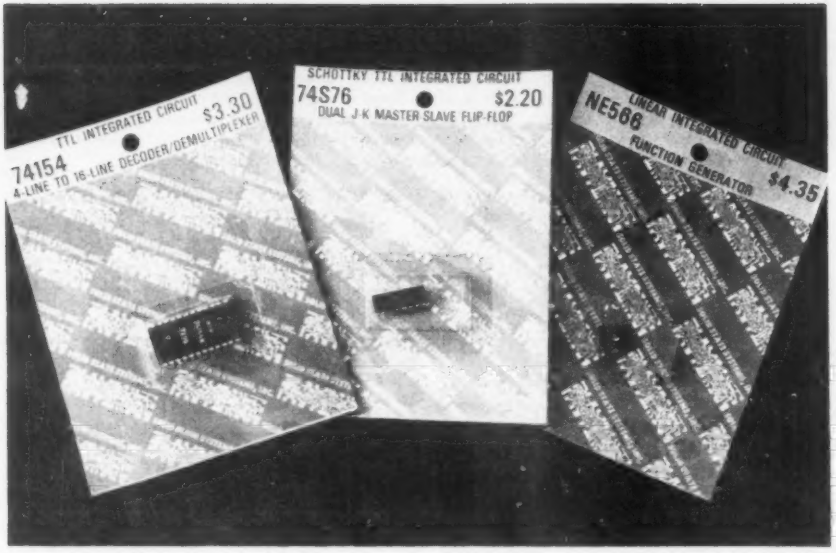


INTRODUCING- UPEC®

UNIT PACKAGED ELECTRONIC COMPONENTS ARE NOW BEING OFFERED BY SOLID STATE SYSTEMS, INC. THESE INDIVIDUALLY PACKAGED IC'S ARE ENCASED IN PLASTIC AND DISPLAYED ON COLOR–CODED CARDS FOR EASE OF SELECTION. THE CARDS HAVE PREDRILLED HOLES FOR DISPLAYING ON A PEG–BOARD OR RACK, AND INCLUDE A DIAGRAM ON THE REVERSE SIDE SHOWING THE ELECTRICAL CHARACTERISTICS OF EACH INDIVIDUAL PART.

FIRST RUN LINEAR, DIGITAL AND SCHOTTKY DEVICES ARE NOW AVAILABLE AND A WIDE RANGE OF CERAMIC DISC AND ELECTROLYTIC CAPACITORS, RESISTORS, LED READOUTS AND OTHER COMPONENTS WILL SOON BE OFFERED. IF YOU ARE INTERESTED IN THE POSSIBILITY OF STOCKING THESE ITEMS IN YOUR STORE, UNIVERSITY OR HOME; OR PERHAPS STARTING YOUR OWN BUSINESS AND WOULD LIKE TO HAVE COMPLETE INFORMATION, PLEASE CONTACT CHRIS ADAMS, RETAIL SALES SUPERVISOR, AT 800-325-2982 (TOLL FREE) OR WRITE TO THE ADDRESS LISTED BELOW.

SOLID STATE SYSTEMS, INC.

P. O. BOX 773 COLUMBIA, MISSOURI 65201

CW or RTTY, whichever way you go,

HAL HAS TOP QUALITY YOU CAN AFFORD!

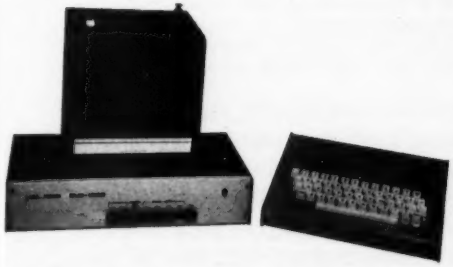
TOP QUALITY RTTY...WITH THE HAL MAINLINE ST-6 TU. Only 7 HAL circuit boards (drilled G10 glass) for all features, plug-in IC sockets, and custom Thordarson transformer for both supplies, 115/230 V, 50-60 Hz. Kit without cabinet, only $135.00; screened, punched cabinet with pre-drilled connector rails, $35.00; boards and complete manual, $19.50; wired and tested units, only $280.00 (with AK-1, $320.00).*

TOP QUALITY...WITH THE HAL 1550 ELECTRONIC KEYER. Designed for easy operation; perfectly timed CW with optional automatic ID for sending call letters, great for DX and RTTY; TTL circuitry, transistor switching for grid block, cathode keying. Handsome rugged crackle cabinet with brushed aluminum panel. With ID, only $90.00; without ID, $65.00.*

OTHER HAL PRODUCTS INCLUDE:

ID-1 Repeater Identifier (wired circuit board)	$ 75.00*
ID-1 (completely assembled in 1½" rack cabinet)	$115.00*
HAL ARRL FM Transmitter Kit	$ 50.00*
W3FFG SSTV Converter Kit	$ 55.00*
Mainline ST-5 TU Kit	$ 50.00*
Mainline AK-1 AFSK Kit	$ 27.50*
HAL RT-1 TU/AFSK Kit	$ 51.50*

TOP QUALITY... WITH THE HAL MKB-1 MORSE KEYBOARD. As easy as typing a letter—you get automatic CW with variable speed and weight, internal audio oscillator with volume and tone controls, internal speaker, and audio output jack. Smooth operation; completely solid-state, TTL circuitry using G10 glass boards, regulated power supplies, and high voltage transistor switch. Optional automatic ID available. Assembled MKB-1, $275.00; in kit form, $175.00. *



NEW FROM HAL—TOP QUALITY RVD-1002 RTTY VIDEO DISPLAY UNIT. Revolutionary approach to amateur RTTY . . . provides visual display of received RTTY signal from any TU, at four speeds (60, 66, 75, and 100 WPM), using a TV receiver modified for video monitoring. Panasonic solid-state TV receiver/monitor, or monitor only, available. RVD-1002, $525.00; Panasonic TV receiver/monitor, $160.00; monitor only, $140.00.*

TOP QUALITY...WITH THE HAL RKB-1 TTY KEYBOARD. Gives you typewriter-easy operation with automatic letter/number shift at four speeds (60, 66, 75, and 100 WPM). Use with RVD-1002 video display system, or insert in loop of any teleprinter, for fast and easy RTTY. Completely solid state, TTL circuitry using G10 glass boards, regulated power supplies, and transistor loop switch. RKB-1 assembled, only $275.00.*

HAL provides a complete line of components, semi-conductors, and ICs to fill practically any construction need. Send $.24 to cover postage for catalog with info and photos on all HAL products available.

*Above prices do not include shipping costs. Please add $.75 on parts orders, $2.00 on larger kits. Shipping via UPS whenever possible; therefore, street address required.

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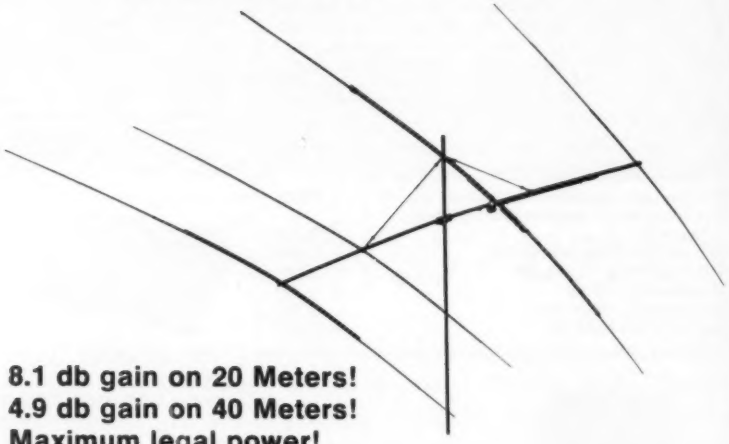
The Most Powerful Antennas Under the Sun

hy-gain

DB-24B

DuoBand Does It Best!

20 AND 40 METERS



8.1 db gain on 20 Meters!
4.9 db gain on 40 Meters!
Maximum legal power!

The Hy-Gain DB-24B is the top combination for top performance on 20 and 40 meters. Uses three full-sized elements on 20 meters and two 2/3 size elements in conjunction with Hy-Gain's perfected linear loading on 40 meters. Unique linear decoupling stubs make two band operation possible without inductance and capacity traps. Feeds with 52 ohm coax and is equipped with balun and Beta Match for optimum energy transfer. F/B Ratio: 20 meters, 20-30 db; 40 meters, 10-20 db. Boom length 24 ft., longest element 43 ft., maximum input 1 kw, AM.

DB-24B...*for top duoband performance!*

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6-Element Super Thunderbird DX
Superior Performance TriBander!

Impressive coverage 10-15-20 meters. Separate, improved Hy-Q traps for each band...SWR less than 1.5:1 on all bands. Takes maximum legal power, up to 1 kw AM, 2 kw PEP. Exclusive Beta Match. Factory pre-tuned. Feeds with 52 ohm coax.

$189.95

TH3Mk3

3-Element Super Thunderbird Popular TriBand Beam Improved!

Outstanding performance 10-15-20 meters at reasonable cost. Separate, matched Hy-Q traps for each band. Exclusive Beta Match for tapered impedance, DC ground. SWR less than 2:1 at resonance. Accepts maximum legal power and feeds with 52 ohm coax.

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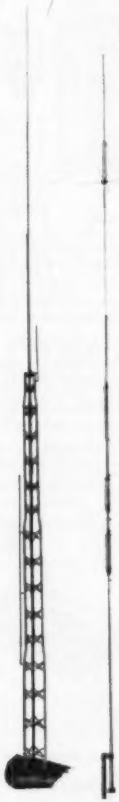

18AVT/WB

The Great Wide Band Vertical Super Performer 80 through 10 meters!

Superb omnidirectional capabilities. Automatic band switching. Beefed-up Hy-Q traps. Top loading coil. True 1/4 wave resonance on all bands. SWR 2:1 or less at band edges. Outstanding low radiation pattern. Entirely self-supporting.

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Incomparable Hy-Tower Finest Multiband on the Market!

Automatic band selection 80 through 10 meters. Unique stub decoupling system isolates electrical 1/4 wavelengths for each band. Takes maximum legal power. Feeds with 52 ohm coax. 24' tower is entirely self-supporting, virtually indestructible. Requires only 4 sq. ft. for installation.

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TABLE TOP CALCULATOR CASE + KEYBOARD

Attractively designed!!!Excellent craftsmanship. Case and keyboard (designed as one unit). Cabinet is made of high-impact plastic beige color with black bezel and amber window. Keyboard consists of a 3 position slide switch and 25 keys, 5 of which are used for memory function. 20 keys gray, 5 keys orange. All keys mounted on one printed circuit board.....

11" wide X 10.5" X 2.9" high

This modular unit is well suited for our calculator chips. Ideal for the CT5005

Case and keyboard complete only $29.95

3 CHIP CALCULATOR

This calculator set provides all of the electronics for an eight digit, floating point calculator with left hand entry. Keyboard, display, clock generator, and display driver is all that need be added to make a calculator that will add, subtract, multiply, and divide. Overflow and negative signals are also provided. Complete instructions to build a calculator included.....

Chips and data------$7.95
Data only----------1.00
(refundable)

CT5005 CALCULATOR

This calculator chip has a full four function memory, which is controlled by four keys, +M (adds entry into memory), -M (subtract entry from memory), CM (clear memory--without clearing rest of registers), RM (read memory or use as entry).

12 digit display and calc.
fixed decimal at 0,1,2,3,4, or 5
leading zero suppression
seven segment multiplexed output
true credit sign display
single 28 pin chip

Chip and data----------$14.95
Data only (refundable)-------- 1.00

5001 CALCULATOR

40 pin calculator chip will add, subtract, multiply, and divide. 12 digit display and calculate. Chain calculations. True credit balance sign output. Automatic overflow indication. Fixed decimal point at 0, 2, 3, or 4 Leading zero suppression. Complete data supplied with chip.

Chip and data, only $9.95
Data only (refundable) $1.00

All IC's are new and fully tested leads are plated with gold or solder Orders for $5 or more will be shipped prepaid. Add 35¢ for handling and postage for smaller orders, residents in California add sales tax. IC orders are shipped within two workdays of receipt of order-kits are shipped withen ten days of receipt of order. $10.00 minimum on C.O.D.'s (phone in).

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KEYBOARD General Telephone $5.95

Ten push buttons (0-9) touch-tone, encoding, programming devices. Easy for panel mounting. Size: 3X2½X1"

MEMORY SALE!!

256x1 BIT Random Access Memory
Fully decoded---TTL Compatible input and output. No clock or refresh required.

INTEL 1101 MOS
16 pin DIP-full data
1¢ per BIT---- each 2.56
10 for $22.56

7400 series DIP

7400	$ .35	74H53	.50		
74H00	.50	7454	.35		
7401	.35	74L54	.50		
74H01	.50	74L55	.50		
7403	.35	7460	.35		
7404	.35	74L71	.30		
74L04	.50	7472	.50		
74H04	.50	74L72	.60		
7405	.35	7473	.65		
74H05	.50	74L73	.90		
74H08	.50	7474	.65		
7410	.35	74L74	.90		
74L10	.50	74H74	.90		
74H11	.60	7476	.70		
7413	1.75	74L78	1.00		
7420	.35	7480	.65		
74L20	.50	7483	1.30		
74H20	.50	7486	.80		
74H22	.80				
7430	.35				
74L30	.50	7491	1.15		
7440	.35	7492	1.15		
74H40	.50	7493	1.15		
7441	1.60	7495	1.25		
7442	1.30	74L95	2.00		
7446	1.75	74107	.70		
7447	1.75	74121	1.60		
7448	1.15	74123	2.00		
7450	.35	74154	2.50		
74H50	.50				
7451	.35	74192	2.50		
74L51	.50	74193	1.50		
74H51	.50	74195	1.10		
7453	.35				

RECTIFIERS

Varo Bridges

VS447	2A	400V	$ .90
VS647	2A	600V	1.10
35A	Stud	400V	1.10
MR810		50V 1A	.10
1N4997		50V 1A	.10
1N4001		1A	.10
1N4002		1A	.11
1N4003		1A	.12
1N4004		1A	.13
1N4007		1A	.17

SCR's

IR122	100V 8AMP	.50
IR122	200V 8AMP	.60
IR122	300V 8AMP	.80
IR122	400V 8AMP	1.00

LED's $ .25

MV-50 red emitting 10-40ma@2V 5 for 1.00

MV5054 red LED 15-100ma@2V $ .30
10 for 2.50

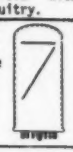
MV-10B Visible red 5-70ma @ 2V $ .30
10 for 2.50

GIANT "NIXIE"

Comes complete with Socket and DD700 202 Numeric Driver. Readability in high ambient light...200 footlamberts brightness!! All DC operation. Long life with no loss of brightness. Compatible with conventional solid state circuitry.

Only $2.25

These were used in the New York Stock Exchange



RCA 2010 NUMITRON

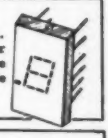
Popular digital display tube. This incandescent five volt, seven segment device provides a .6" high numeral which can be seen from a distance of 30 feet. The tube has a standard nine pin base (solderable) and a left hand decimal point....

$5.00 each

$4.00 each for 5 or more

MAN1

Seven Segment, 0-9 plus letters. Snaps in 14-pin DIP socket or Molex. Operates with IC voltage requirements. Long operating life



$4.25 each

MAN4

Seven segment, 0-9 plus letters. Right hand decimal point. Snaps in 14-pin DIP socket or Molex. IC voltage requirements. Ideal for desk or pocket calculators!

Each.....$ 3.00
Ten or more..$25.00 red lens

MAN3

0-9 plus letters. Right hand decimal point. Flat-Pack type case. Long operating life. IC voltage requirements. Ideal for pocket calculators !!!!!

Each.....$ 2.50
Ten or more..$20.00 red lens

'73' SPECIALS

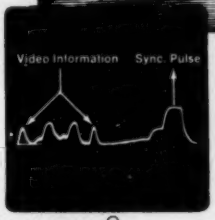
LINEARS

NE531	op amp TO-5	$3.00
NE560	phase lock loop DIP	3.25
NE561	phase lock loop DIP	3.25
NE565	phase lock loop TO-5	3.25
NE566	function generator TO-5	4.00
NE567	tone decoder TO-5	4.00
NE5556	op amp DIP	1.00
709	popular op amp DIP	.45
710	voltage comparator DIP	.50
711	dual comparator DIP	.40
723	precision voltage regulator DIP	1.00
747	dual 741 op amp DIP	1.00
748	op amp TO-5	1.00
LM100	positive DC regulator TO-5	1.00
LM302	op amp voltage follower TO-5	1.25
LM1595	4 quadrant multiplier	$2.00
LM311	comparator TO-5	1.75
LM380	2W audio amp DIP	1.75
LM703	RF-IF amp epoxy TO-5	1.00
LM309H	5V-200ma power supply TO-5	1.00
LM309K	5V-1A power supply module TO-3	2.00

2nd generation slo-scan system

Venus Slo-Scan TV monitor

Actual unretouched photo taken from the Venus SS2 using a Polaroid Color Pack II Camera mounted on the Venus P-1 Camera Adapter



CAMERA ADAPTER Mounting Bezel

BRIGHTNESS Automatic CRT Burn Protection

CONTRAST Independent Contrast Control

SOURCE SELECT Rec., Tape, Camera Off & Instant On

PERSONALIZED IDENTIFICATION PLATE Your call sign

CABINET Zinc Die Cast Front with Extruded Alum Sides 10¾"Wx13"D x5½"Ht.

Amat. Net $349.00

OPTIMUM PICTURE 3¼" x 3¼" for POLAROID LAND reproduction

TILT STAND Collapsible Bail

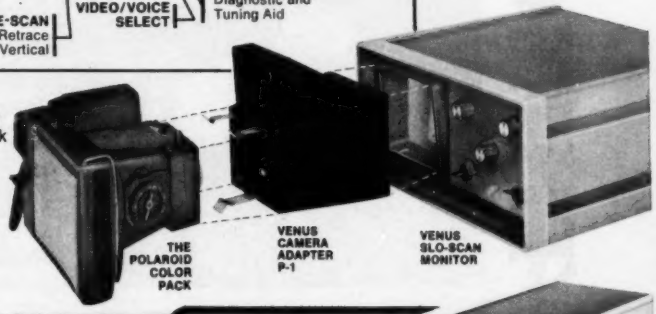
RE-SCAN Retrace Vertical

VIDEO/VOICE SELECT

ACCU SYNC⊖ Diagnostic and Tuning Aid

CAMERA ADAPTER P-1 enables you to take photographs "right-off-the-air" and accepts a Polaroid Color Pack or a Polaroid Square Shooter.

- **Allows photographing in a lit room**
- **Simple-snap mounting for quick and accurate picture taking**
- **Simultaneous hood viewing of picture being taken by camera**
- **Instant QSL via SSTV**
- **Amat. Net $34.50**



FRAME GRABBER

Venus' Cassette F and T Series are continuous loop cassettes that allow you to easily pre-record and send SSTV information

F1 *Single frame cassette* **Amat. Net $3.75**

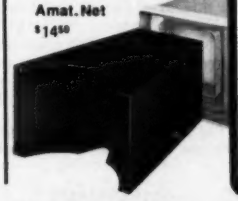
TG *Grey Scale Generator* **Amat. Net $6.50**

TC *Checkerboard* **Amat. Net $6.50**

V1 VIEWING HOOD

Uniquely designed for wide angle viewing by more than one operator.

Amat. Net $14.50

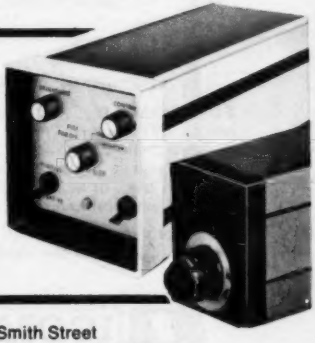


Coming in December

CAMERA AND SCAN CONVERTER CC-1

Projects your VIDEO real time on any conventional home TV while simultaneously scan converting to SSTV

- **Full, half and quarter frame**
- **Positive, negative reversal**
- **RF output for viewing on conventional home TV set**



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Venus Scientific Inc.

The company that put high voltage on the moon, now brings you expanding amateur radio technology.

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Let Santa's Little Helper fill your Christmas Stocking by seeing . . . or writing your nearby ICOM dealer today . . . and see the entire family of Inoue's unique and advanced FM gear . . . time's a wastin'. . . !

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Pampa, TX 79065

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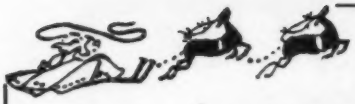
IF YOUR DEALER DOESN'T STOCK ICOM EQUIPMENT, LET THE ICOM DISTRIBUTOR FOR YOUR REGION KNOW.



UP DANCER
UP PRANCER
DOWN FM-27B

Down to $429.95. . .The FM-27B Transceiver
During Clegg's 1-Month Factory Authorized Holiday Sale!

CHECK THESE SPECIFICATIONS

GENERAL

POWER REQUIREMENTS: 12 to 14 VDC
Current Consumption at 13.5 VDC:
Receive: 4 amps squelched, 1.2 amps unsquelched.
Transmit: 6 amps max.

DIMENSIONS: 7 3/8" x 3 1/2" x 9 1/4" deep; 4 lbs. net weight.

RECEIVER

TUNING RANGE: 146.00 to 148.00 MHz, continuously tuneable with reset capability of approx. 1 KHz to any frequency in range.

SENSITIVITY: .35 μv max. for 20 db quieting; .1 μv for reliable squelch action.

SELECTIVITY: 11 KHz at 3 db; Less than 30 KHz at 70 db. Adjacent (30 KHz spaced) channel rejection more than 70 db.

AUDIO OUTPUT: 2.0 watts (min.) at less than 10% THD into internal or external ohm speaker.

TRANSMITTER

TUNING RANGE AND CONTROLS: Same as RECEIVER.

POWER OUTPUT: 25 watts Min. into 50 ohm load. P/A transistor protected for infinite VSWR.

MODULATION: Internally adjustable up to 10 KHz deviation and up to 12 db peak clipping.

During December only, you can save $50.00 on the purchase of THE 2-meter rig, the Clegg FM-27B. The only 2-meter transceiver with any combination of transmit or receive frequency from 146 to 148 MHz, the FM-27B needs NO ADDITIONAL CRYSTALS. It gives you built-in total coverage, reliability, and dependable performance. Take advantage of this one-month factory authorized special and start 1974 with Clegg's 2-meter leader. Act today. Call us now so we can wish you a happy holiday or give you more information.

MERRY CHRISTMAS

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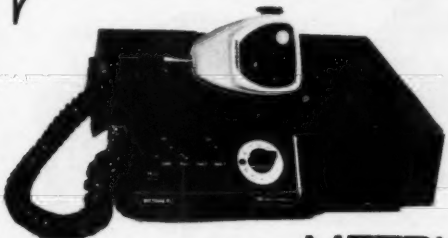
Mann has the NEW



Announcing the new METRUM II
2 meter FM radio (144-148 MHz) by
MOTOROLA

Famous Motorola FM 2-way radio technology and leadership now brings the highest quality in the industry to the amateur radio user. Available in 25W or 10W models, both switchable to 1W. Integrated circuitry virtually eliminates RF interference. 12 channel capability.

10 Watt – $399.95 **25 Watt – $499.95**

features:

- 25 or 10 watts of power, both switchable to 1 watt
- 12 channel capability
- Shipped to receive and transmit on 146.94 MHz
- Only one crystal per channel is required. Each crystal provides both the transmit and receive frequency for simplex operation.
- Transistorized pre-amplifier in palm-type microphone in shockproof housing
- Solid state design eliminates open or mechanical relays—assures dependable, trouble-free operational reliability
- Push button repeater switch allows simplex or repeater operation
- Indirect, non-glare illuminated panel controls can be seen under any adverse lighting condition
- Reversible METRUM II control panel

Mann has USED

Motorola P33BAM 150 MHz 5 Watt Portable less Btry. & Ant. $59
Motorola T43GGv 150 MHz 30W Vibrator Mobile w/Acc. $69
Motorola T41GGV 40–50 MHz 30W Vibrator Mobile w/Acc. $54
DuMont Base 117Vac 150 MHz 60W Less Control Panel $99
Motorola U44BBT–1000 18W 450 MHz T-Power w/Acc $89

G.E. Strips 450 MHz Progress Line

Xmtr – $15
Rcvr – $20

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Your BANKAMERICARD welcome here

VIDEO TAPE RECORDERS

BELL & HOWELL MODEL 2965

This is a portable system and comes with recorder, camera and charger. A TV monitor is built into the recorder. Camera includes built-in Microphone and Zoom lens. Recording time is 20 minutes on 5" tape. Recording is both video and audio.

SPECIFICATIONS

RECORDER:
Built-in 2:1 EIA Sync Generator
AGC: Audio & Video
RESOLUTION: 525 lines, HOR. RESOLUTION: 300 lines
AUDIO RESPONSE: 80-10,000 Hz
POWER REQUIREMENTS: 12V DC, 10 watts
BATTERIES: 2/3G x 3/U Rechargeable (not included)
CHARGER: Model 105905 included

CAMERA:
RESOLUTION: 525 lines HOR. RESOLUTION: 500 lines
VERT. FREQ: 60 Hz (EIA)
HOR. FREQ: 15,750 Hz (EIA)
VIDEO OUTPUT: 1.0 p-p, 75 ohm, unbalanced
MIN. ILLUMINATION: 30 lux.
VIEWFINDER: 1½" (1" CRT w/magnifier)
LENS: 5:1 zoom F2 – 22
SHIPPING WT. 35 lbs.

LIST: $1595

OUR PRICE (NEW) **$550.00**

BELL & HOWELL Model 2960 – SHIBADEN SV700UC

(Assemble, Edit and Stop Motion)

This video recorder will record directly from a standard TV set or a TV camera. It will play back over your home TV set. Audio may be dubbed onto the tape. A 7" reel (2400') will record 1 hr. No home VTR unit under $1000 can match the quality and capabilities of this unit.

SPECIFICATIONS

RESOLUTION: 525 lines, Standard TV or CCTV recording
VIDEO: Input and output: 1.0V p-p, 75 ohms, unbalanced. Greater than 3.5 MHz freq. response. 300 lines plus Hor. resolution.
AUDIO: Mike or line inputs. 60-10,000 Hz freq. range
POWER REQUIREMENTS: 110V AC, 95 watts
DIMENSIONS: 18 3/8" W x 10 3/16" H x 15 11/16" D
AGC or Manual Audio & Video gain
POWER REQUIREMENTS: 110V AC, 95 watts
WEIGHT: 65 lbs.

LIST PRICE (1972) $995.00

OUR PRICE (NEW) **$450.00**

(USED) **$250.00**

Experimenter's Special **$100.00**

MAINTAINANCE MANUAL **$5.00**

ORDER BLANK

Please rush _____ Bell & Howell model/s 2966_____Bell & Howell model/s 2965

_____Rolls, Video Tape_____Batteries_____Color Adapters

Price_____

to: Name_____

Shipping_____

Address_____

Total _____

City_____State_____ZIP_____

RECHARGEABLE BATTERIES – New, for Porta Pak . **$36.00** a set.

COLOR ADAPTERS – limited number available, will work with almost any Black and White VTR to convert to NTSC color, record-playback-does not impair monochrome use. **$450.00** ea. prepaid.

NEW NAME BRAND VIDEO TAPES – 2400 ft. (1 hr.) any quantity available, shipping wt. 2 lbs. **$29.00** each.
1200 ft. (½ hr.) **$19.00** each.

CONDITIONS OF SALE:

NEW EQUIPMENT – sold new. Guaranteed 90 days. Replaced or repaired by us, if found defective upon arrival.

USED EQUIPMENT – sold *as is* in good working order. NO warranty. All units checked prior to shipment.

EXPERIMENTER'S DELIGHT – used *as is* repairable. Physically intact not beat to hell, but requiring some work. Problems and probable causes listed with each machine.

PARTS – available at near giveaway prices, through us.

SERVICE – units can be serviced by any competent video technician, as well as through Bell & Howell AV Service and Shibaden in Melrose Park, Illinois.

QUANTITY DISCOUNT – on orders of more than 10 machines.

DEALER INQUIRIES – are invited for sale of new equipment.

New machines have standard Japan EIA 8P connector to mate with all popular VTR monitors. Used machines have all coax and cannon xl connectors. Used machines do not have AGC or edit ability, but are otherwise identical and interchangeable.

All sales are final. Cash with order. Shipped best way. Freight charges collect.

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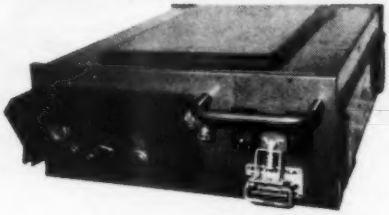
Motorola Special Model X71GJT-1190B,

12 volt transistor powered mobile in 15" case, 100 watts. 2 Freq. transmit and 3 freq. receive capability.
2 Freq. Tx. and 2 freq. Rx. on 40-50 MHz. range; a separate Rx. front end allows a 3rd Rx. freq. on 30-40 MHz.



With accessories . . . **$228**

The General Electric

Message Mate

personal pocket voice receiver with sel-call

150-162 MHz, 162-174 MHz
Specify Frequency Range When Ordering.

$78 less reeds

(Charger included with nickel-cadmium model)

With new mercury battery . . . **$68**

Ask about low band models.

- Fully transistorized, 100% solid-state for the ultimate in reliability and performance.
- Selective signaling options provide for individual messages both inside and outside of buildings.
- Operates in full compliance with Part 15 of the FCC rules.

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S&R makes economy exciting!

BEST BUY ANYWHERE!

Motorola RF Transistors Unmarked

Type	Qty.	Price
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2N5590	112	3/9.50
2N5591	44	3/20.00
2N6080	222	3/6.00
2N6081	280	3/9.50
2N6082	173	3/16.00
2N6083	173	3/24.00
2N6084	260	3/30.00
2N6166	50	3/50.00
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Motorola RF Transistors Marked

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2N3950	13	10.00
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2N4073	2	1.00
2N5109	1361	1.25
2N5177	1	6.00
2N5179	1744	.35
2N5583	1	3.00
2N5590	30	5.00
2N5591	4	9.00
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2N6081	20	6.50
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2N6083	25	15.00
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2N6097	21	15.00
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THE SCOTCHMAN'S DREAM

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RF Transistors	Price Each	Our Price
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S3001	3.75	3.00
S3002	8.20	6.50
S3003	20.00	15.00
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S3007	24.95	19.00
S3008	2.18	1.60
S3010	4.90	3.00
Hot Carrier Diodes		
HEPR0700	1.09	1.00
V.C.C.		
HEPR2500	1.10	.88
R2501	1.10	.88
R2502	1.10	.88
R2503	1.10	.88
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Waveline 611	1	5.00
PRD 154	1	5.00
M.C.S. P-265-1	2	7.00
PRD 559A	1	15.00
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Omni Spectra 201845/J	8	5.00
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H. P. X281A	1	5.00
H. P. 420B	2	10.00
H. P. 775D	1	50.00
PRD X1410	1	5.00
FXR X601A	1	6.00
PRD 195A	2	6.00
PRD 195B	2	10.00
Rantec MX-200	2	4.00
Waveline 554	4	4.00
Narda 301	1	10.00
FXR X1551	1	6.00
PRD 188A	2	10.00
FXR X410B	1	10.00
Narda 1011	1	10.00
H. P. H750D	1	10.00
Varian VA1281B	1	7.00
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Demornay Bonardi L-234	1	10.00
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Demornay Bonardi L-010	1	10.00
L. H. Terpening Co. 3232-550	1	10.00
Guide Ind. Inc. 1516-.5	2	10.00
H. P. 430C	2	20.00
H. P. 430B	1	15.00
Narda 438	1	20.00

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Microwave Semiconductors Corp.

	Price
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D1-28	3.75
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Dickson Fast Recovery Diodes

1N3891	2.00
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6360	5.00
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5894A	17.00
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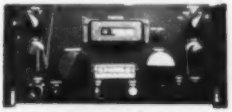
8032	2.00
8106	1.00
8458	5.00
6907	7.50
7377	7.50
8683	7.50
5762/7C24	100.00

(25)

ANOTHER SELECTRONIC SPECIAL
The R648/ARR 41 Receiver

Can be best described as a mini version of the R390A rec, and has most of the key features of the 390A.



Digital readout 500 kHz to 24.999 MHz
1.4 kHz to 6 kHz mechanical filters
500 kHz to if, Double conversion
Xtal calibrator, 500 ohm output
17 tubes
8" x 17" x 12" – Weight: 34 pounds

Receiver has been tested, overhauled, and guaranteed. **Excellent condition Price: $175.00**

We have a few receivers with AC power supply installed. **Price: $199.50**

Solid State 866A Direct Replacement
Price: $5.95 ea. or 2/$10.00

R508 VHF Rec. 118-148 MHz
Price: $14.95 ea.

R.F. AMPLIFIERS

TUNES 50 to 100 mhz – COMPACT ALL ALUM. CASE 12" x 15" x 6¾" WITH SK 600 EIMAC SOCKET. 1 LARGE AIR VARIABLE CAP. – 2 SMALL AIR VARIABLE TRIMMERS – TEFLON MOUNTED ROTARY INDUCTOR – GOOD FOR LINEAR AMPLIFIER – CAN USE EITHER 4 CX150A or 4 CX250 – LESS TUBE, PRICE: ....$14.95 ea.
WITH 4 X150A, PRICE: .....$19.95 ea.

ADJUSTABLE PRINTED CARD BOX
For Rack Mount
5" to 7¼" – 16 slides and sockets – includes 30 double contact position edge connector type
Price: $9.95 ea.

Receiver type VHF-2RM 108-135 MHz crystal control Double Conversion AM with AVC noise limiter and squelch-tunable. 115 volts, 50-60 cycles. Price: $24.95.

WINTRONIX MODEL 850 INDUCED WAVE FORM ANALYZER. This unit, in conjunction with your present oscilloscope, permits you to view wave forms in the range from audio thru MHz without any direct connection. The probe is simply placed over the tube in question and the wave form is displayed on the oscilloscope. It may also be used as a high gain amplifier to increase scope sensitivity. Excellent for TV, radio, amplifier, and transmitter repair and maintenance. Brand new, with probe.
SHIP WT. 13 lbs. Price: $19.95 ea.

MODULE TYPE POWER SUPPLY TRANSISTOR, REGULATED.
115V – 60 cycle in +12 –12 –6V @ 3 amp output. Front Panel adj + or –10%. On-off switch. Fuses. Barrier strip output. 6" x 5" x 7". Excellent Cond.
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Make your own counter, frequency meter, digital voltmeter, readouts, etc.
Kit includes
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1 transformer
1 P/S board w/socket
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11½" H x 18" D x 19" W. 8" panel openings w/rubber feet and disappearing handle.
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32,500 @ 25V
55,000 @ 15V
100,000 @ 8V
50¢ each or 5 for $2.00
40,000 @ 10V
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PRICE: 3 for $1.00

Receiver R-36/GR 225-400 MHz. Crystal Control Double conversion FM with squelch and noise limiter. 600 ohms output. 115-230 Volts, 50-60 cps. Price: $24.95

Coaxial relays, single pole - double throw, available in UHF,BNC, Type N. Specify.
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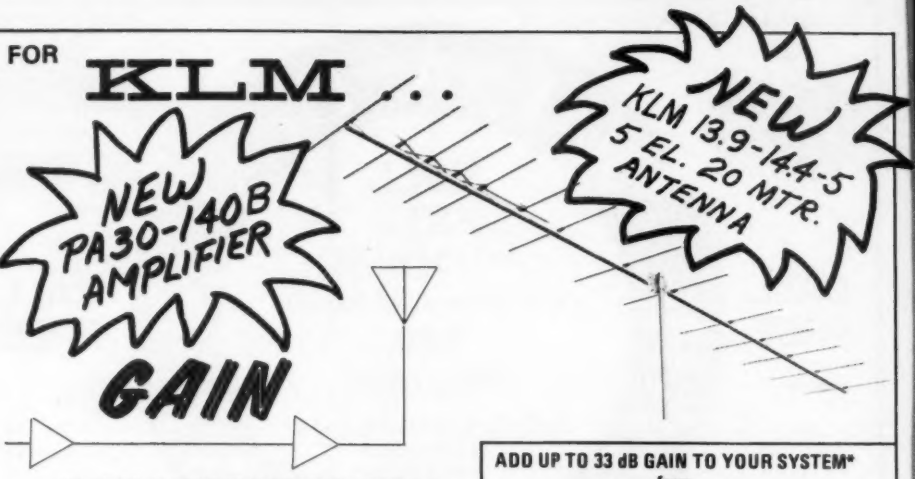
NEW KLM 13.9-14.4-5 5 EL. 20 MTR. ANTENNA



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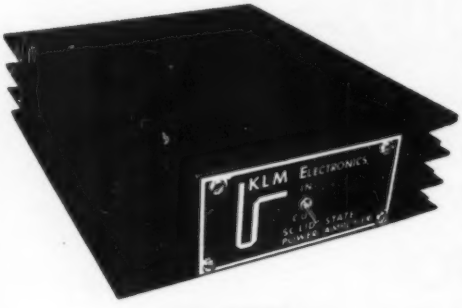

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40-130	KLM 40-130	7 typ.	125.95
50-52	KLM 50-52-8	12	55.95
50-52	KLM 50-52-11	14	89.95
144-148	KLM 144-148-7	9†	21.95
	KLM 144-148-8	10.3	26.95
	-9	11.5	31.95
	-11	12.2	35.95
	-12	13.5	38.95
	-14	14.2	45.95
144-148	KLM 144-148-16	14.8	49.95
220-225	KLM 220-225-9	11.5	20.95
	-11	12.2	25.95
220-225	KLM 220-225-14	14.1	34.95
420-450	KLM 420-450-14	11.5†	19.95
420-450	KLM 420-450-27	14.5	41.95

AMPLIFIERS

Frequency (MHz)	Model	Input Range (w)	Nominal P_O (w)	PRICES
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	PA10-40B	5 – 15	40	79.95
	PA10-70B	5 – 15	70	129.95
	PA2-70B	1 – 4	70	149.95
	PA10-140B	5 – 15	140	179.95
	PA2-140B	1 – 4	140	199.95
	PA 30-140B	15-40	140	169.95

† Rearmountable
** PA2-140B and KLM 144-148-16*

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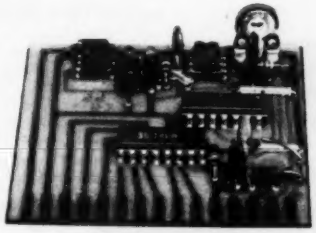
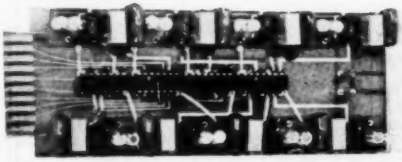


12/16 BUTTON TOUCH-TONE DECODER

Uses NE-567 decoder IC's and 7402 AND gates. Frequencies are pot variable. Response times are fixed by capacitors. (200 ms. unless otherwise specified).
Outputs are ANDed TTL logic highs.
Requires: 5V

Board:		$10.00
Kit:	12 button –	77.00
Kit:	16 button –	88.00
Tested:	12 button –	85.00
	16 button –	98.00

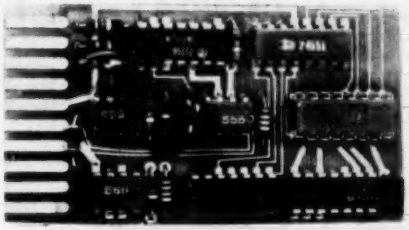


RTTY R-Y GENERATOR

Uses two NE-555 timers, 7420 and 7493 IC's. Outputs repetitive or clutched zero-bias test signals in Western Union format. Used to check printer range and aid proper adjustment. Requires 5 volts. Loop driver circuitry.

Board:	$ 1.75
Kit:	8.00
Tested:	11.00

THE IDENTIFIER TO END ALL IDENTIFIERS



CW/RTTY/REPEATER IDENTIFIER

Uses 8223 Programmable read-only-memory. NE-555 timers for clock, tone generator and 5 minute timer. Apply 5 volts (200mA) and COR (ground) and it outputs tone (5 VPP) and PTT (5V).
256 bit plug-in memory is programmed to your specifications or call.
Dits and element spaces = 1 bit.
Letter space = 2 bits.
Dash = 3 bits.
Word space = 4 bits.
Typical full memory: CQ FD CQ FD FD DE WAØVTU/Ø K
Can also be programmed to output up to 32 RTTY characters, 5 level Baudot, double stop. See ARRL Manual "FM and Repeaters" page 136.
For 5 minute timer and tone oscillator add $5.00 to Kit price and $6.00 to Tested Unit price.

Additional factory programmed memories:	$14.00
Board:	8.00
Kit:	25.00
Tested:	29.00

2 METER PREAMP

40673 or MFE3007 Dual Gate FET. Very small size–1 1/8 X 1 5/8 inches. 16 db. gain, 2.5 db. noise figure.

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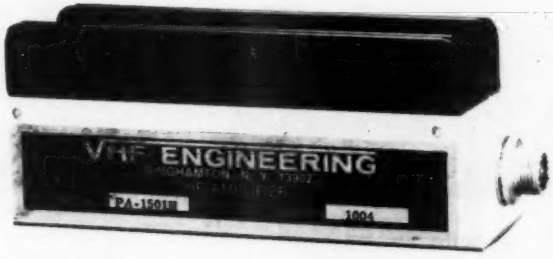
  PA-2501H – 25-30 WATTS OUT
- ONLY 2" x 2½" x 6"
- 12-14 VOLTS
  NEGATIVE GROUND
- LESS THAN 1 DB
  LOSS ON RECEIVE
- SOLID STATE
  SWITCHING



PA1501H	**$49.95**	**WIRED & TESTED**	**$39.95**	**COMPLETE KIT**
PA2501H	**$69.95**		**$59.95**	

Also available:

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- **RX-144/220F** 2/220 receiver kit w/ceramic filter 65.95
- **RX-144/220C** 2/220 receiver kit w/crystal filter 69.95
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- **PA-432** 10 watt amp less cabinet, connectors, and switching 39.95
- **PS-12** 12 amp regulated 12-15 volt power supply kit 59.95
- **PS-12W** Wired/tested 69.95
- **PS-24** 24 amp same as PS-12 less case 69.95
- **COR-1** COR with 3 second and 3 minute timers 19.95

Write for data sheets on any above units. Add postage. NY state residents add sales tax.

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wired and tested

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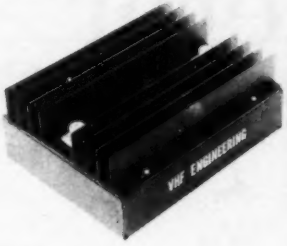

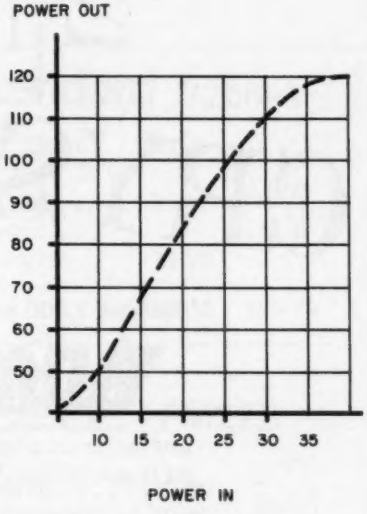

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2N3866	1W	400 MHZ	1.40
2N5589	3W	175 MHZ	5.75
2N5590	10W	175 MHZ	9.50
2N6080	3W	175 MHZ	5.95
2N6081	15W	175 MHZ	12.50
2N6082	25W	175 MHZ	16.50
2N6084	40W	175 MHZ	25.00
CTC-B25-12	25W	175 MHZ	15.95
CTC-B40-12	40W	175 MHZ	22.50
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SBE SB144

SB144	259.00
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3 extra sets of crystals	29.70
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FM27B	479.00
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GAM has what your repeater needs

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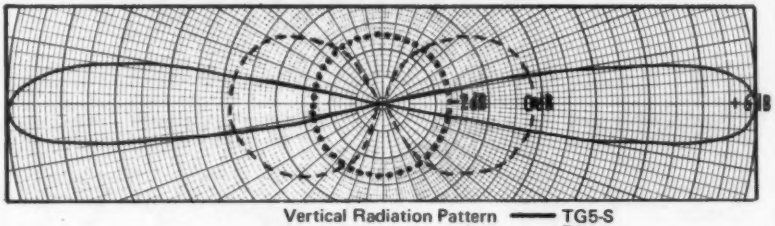
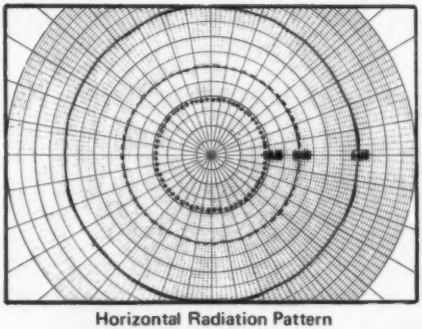
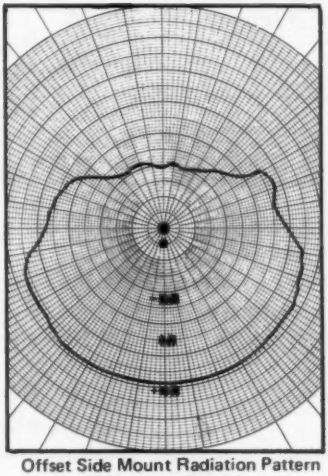


Vertical Radiation Pattern — TG5-S
- - - Dipole
• • • • Isotropic



Horizontal Radiation Pattern
— TG5-S
- - - Dipole
• • • • Isotropic



Offset Side Mount Radiation Pattern
Reference: Dipole

(ON FILE WITH FCC)

MODEL TG5-S

$104.50 LIST PRICE

Weight 3½ lbs.

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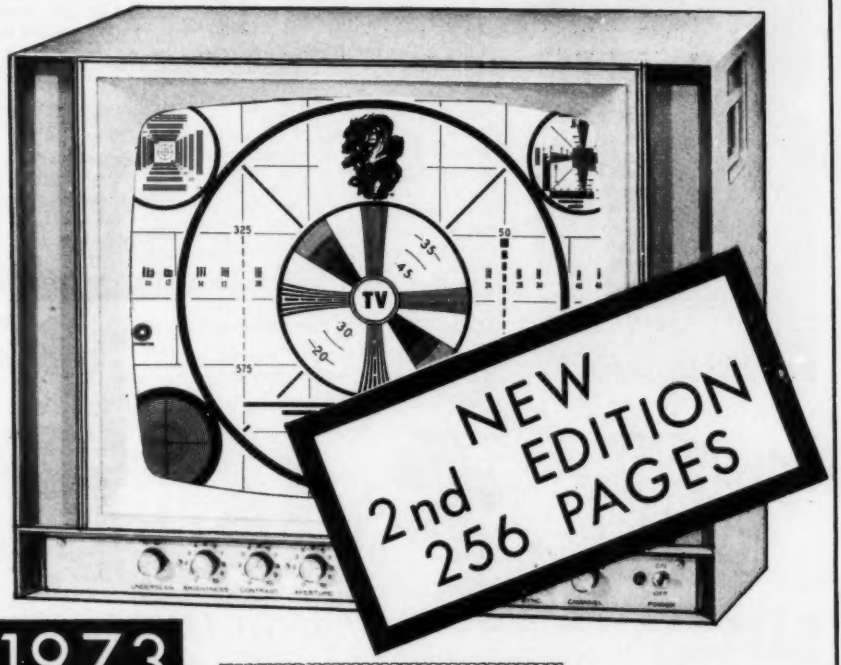

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1974
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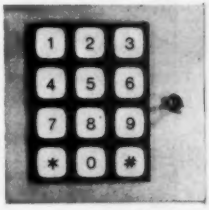
UT–1

Portable Tune Up Meter with cables to plug into Motorola, Link, GE, Standard, etc. This unit gives you the meter functions of the radio being tested. It also operates as a portable dc voltmeter with the following full scale ranges: 1.5, 5, 15, 50, 150, 500, 1 KV with a special 3 volt range for GE Progress Line equipment. The UT-1 can be set zero center for discriminator readings. Also featured in the UT-1 is a field strength meter. Place your order now. Kit form **$42.50.** Wired **$49.95.** Extra cables of your choice (specify rig) . **$5.00 ea.**

($2.00 for postage and handling.)

TESCO–PAD



The "TESCO–PAD" has no tuned coils to go off frequency, no tuning necessary or even there! It's all in one "Black Box I.C." ready to go. The "TESCO–PAD" has a 1 second hold-up for your transmitter, complete P.T.T. operation, available with dual audio output levels, 12 or 16 tone combinations.

KIT $34.95 **$39.95 Wired**

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($2.00 for dual output version)

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- Nominal Output: 50 A at 12 Vdc
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- Will run a mobile rig & even an amplifier from 110 Vac

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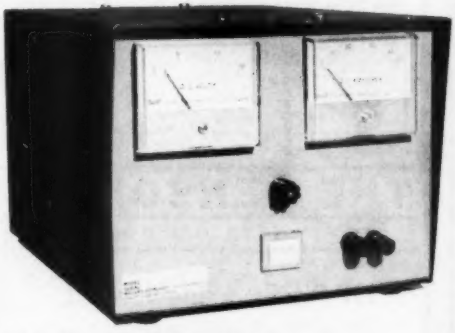

$100 KIT

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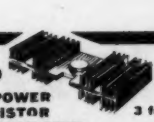

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☐ MAN-1	.27 h.	Monsanto
☐ MAN-4	.19 h.	Monsanto
☐ 707*	.33 h.	Litronics
☐ 704**	.33 h.	Litronics
☐ SLA-1*	.33 h.	Opcoa

* Pin-for-pin MAN-1. ** Pin-for-pin MAN-4, elec. char. same

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READOUTS — TYPE	No. Size	Color Display	Decimal	Mils	Driver	Each	Special
☐ MAN-1 equal	.27	Red	Yes	20	SN7447	$4.50	3 for $12.
☐ MAN-1A equal*	.27	Red	Yes	20	SN7447	4.95	3 for $13.
☐ MAN-3 equal	.115	Red	Yes	10	SN7448	2.50	3 for $6.
☐ MAN-3A equal*	.115	Red	Yes	10	SN7448	2.50	3 for $6.
☐ MAN-3M equal*	.127	Red	Yes	10	SN7448	2.50	3 for $6.
☐ MAN-3 equal	.115	Red	***	10	SN7448	1.95	3 for $5.
☐ MAN-3M equal*	.127	Red	Yes***	10	SN7448	1.95	3 for $5.
☐ MAN-4 equal*	.190	Red	Yes	15	SN7448	3.25	3 for $9.
☐ MAN-4 equal*	.190	Red	Yes***	15	SN7448	2.75	3 for $8.
"REFLECTIVE LITE BAR" (Segment LEs Readouts)							
☐ 707** (MAN-1)	.33	Red	Yes	20	SN7447	3.25	3 for $6.
☐ 704** (MAN-4)	.33	Red	Yes	20	SN7448	3.25	3 for $6.
☐ SLA-1** (MAN-1)	.33	Red	Yes	20 15	SN7447	3.25	3 for $6.

* Red epoxy case, others clear. ** Litronix and Opcoa's pin-for-pin equals and electrical specs as MAN-1 or MAN-4. *** LED "dot" missing.

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☐ SN7402	.30	☐ SN7437	.60	☐ SN7473	.52	☐ SN74106	1.25	☐ SN74163	1.95
☐ SN7403	.30	☐ SN7438	.60	☐ SN7474	.52	☐ SN74107	.70	☐ SN74164	3.50
☐ SN7404	.35	☐ SN7440	.30	☐ SN7475	.95	☐ SN74108	1.25	☐ SN74165	3.50
☐ SN7405	.32	☐ SN7441	1.40	☐ SN7476	.55	☐ SN74112	1.25	☐ SN74166	2.05
☐ SN7406	.55	☐ SN7442	1.25	☐ SN7477	1.30	☐ SN74113	1.25	☐ SN74174	2.10
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☐ SN7408	.35	☐ SN7444	1.50	☐ SN7480	.75	☐ SN74121	.80	☐ SN74176	2.10
☐ SN7409	.35	☐ SN7448	1.50	☐ SN7481	1.15	☐ SN74122	.85	☐ SN74177	2.10
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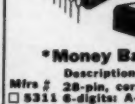

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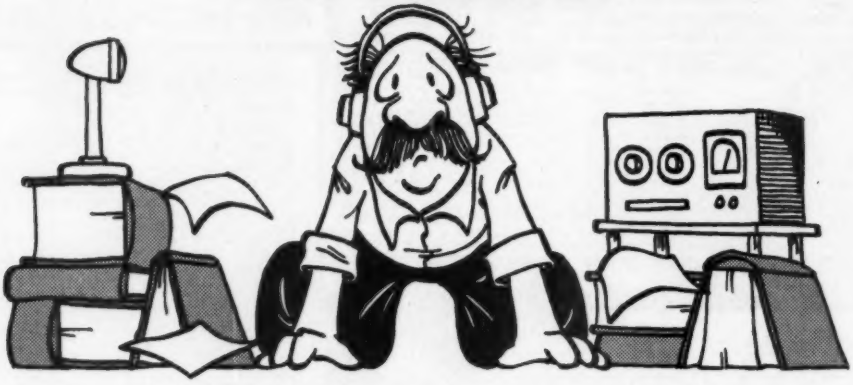

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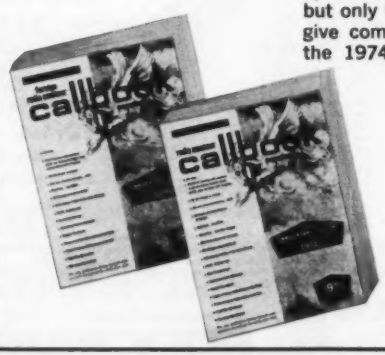

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1 and 6w 2m amplifiers–WB4DBB 31 Apr
Transistor RF amps, II–W9EGQ 93 Apr
ISC FM xmtr mod–WB6QAM 109 Apr
1w 2m FM xmtr–WB6BIH 65 May
6m 5w amplifier–K1CLL 83 May
QRP on 180 kHz?–W5SOT 93 May
220 signal generator–K1CLL 23 Jun
Hybrid 40m xmtr–WB6BIH 55 Jun
VHF pwr amp design–K6RAD 31 Aug
Amateur's intercom–K1CLL 39 Aug
QRP transmitter–WB6BIH 65 Aug
450 MHz exciter–K1CLL 71 Aug
2kw building block–W2EEY 31 Oct
Freq. mult w/xstrs–K1CLL 69 Oct
2m linear amp–W4KAE 29 Dec
Microphone preamp–WA6QJU 71 Dec

UHF AND ABOVE

450 MHz preamp–WB6BIH 33 May
UHF output meter–K2EE 37 Jun
T-44 ATV system–WB0FQF 29 Jul
450 MHz power divider–WA3AXV 57 Jul
450 MHz exciter–K1CLL 71 Aug
Measuring microwaves–WA9VFG 17 Oct
450 MHz, getting started–K1CLL 21 Nov
ATV, getting started–WA7NMO 26 Nov

VHF
(Also See FM)

6m converter– K1CLL 79 Jan
IC 10m tuner for VHF–K1CLL 99 Jan
6&2 surplus power–K4EPI 35 Mar
Taming FETs on 2m–K1CLL 27 Apr
1 and 6w 2m amplifiers–WB4DBB 31 Apr
6m 5w amplifier–K1CLL 83 May
220 signal generator–K1CLL 23 Jun
VHF pwr amp design–K6RAD 31 Aug
2m converter–WB6BIH 65 Sep
One IC 2m front end–K1CLL 21 Oct
Freq. mult. w/xstrs–K1CLL 69 Oct
2m linear amp–W4KAE 29 Dec
Portable 2m beam–W1BHD 89 Dec

VISITS

Visit to Yaesu– WB6IZF 37 Jan
73 visits Jordan–W2NSD 12 Sep
73 visits Sentry–W2NSD 81 Sep

PROPAGATION CHART
J.H. Nelson
Good (Open) Fair (□) Poor (O)

December 1973

SUN	MON	TUES	WED	THUR	FRI	SAT
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Possible aurora 19, 20.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7	7	3	3	3	3	3	7	14	14A	14A
ARGENTINA	14	7	7	7	7	7	14	21	21	21	21	14
AUSTRALIA	14	7B	7B	7B	7	7	7B	7A	14	14	14	14
CANAL ZONE	14	7	7	7	7	7	14	14A	21	21	21	14
ENGLAND	7	7	7	3	7	7B	14	21	21	14	7B	7
HAWAII	14	7B	7	7	7	7	7	7B	7A	21	21A	21
INDIA	7	7	7B	7B	7B	7B	7A	14	7B	7B	7	7
JAPAN	14	7B	7B	7	7	7	3A	7	7B	7B	7B	14
MEXICO	14	7	7	7	7	7	7	14	21	21	21	14
PHILIPPINES	14	7B	7B	7B	7B	7	7	7	7	7B	3B	7
PUERTO RICO	7	7	7	7	7	7	14	14	14A	14A	14	14
SOUTH AFRICA	7	7	7	7	7	7B	14	21	21A	21	14	14
U. S. S. R.	7	7	3A	3A	7	7B	14	14A	14	7B	7	7
WEST COAST	14	7	7	7	7	7	7	14	21	21A	21A	14

CENTRAL UNITED STATES TO:

ALASKA	14	7	7	3	3	3	3	3	7	14	14A	21
ARGENTINA	14	7A	7	7	7	7	7	14	21	21	21	21
AUSTRALIA	14A	14	7B	7B	7	7	7B	7	14	14	14	14
CANAL ZONE	14	7	7	7	7	7	7	14	21	21	21	21
ENGLAND	7	7	7	3	7	7	7B	14	14	14	7B	7
HAWAII	14A	14	7	7	7	7	7	7	7A	21	21A	21
INDIA	7	7	7B	7B	7B	7B	7	7A	7	7B	7B	7B
JAPAN	14	7B	7B	7	7	7	3	3A	7	7B	7B	14
MEXICO	14	7	7	3	3A	3A	3	7	14	14A	14A	14
PHILIPPINES	14	7B	7B	7B	7B	7	3A	3A	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	7	14A	21	21	21	14
SOUTH AFRICA	14	7	7	7	7	7B	14	21	21	21	21	14
U. S. S. R.	7	7	3A	3A	7	7	7B	14	7B	7B	7B	7

WESTERN UNITED STATES TO:

ALASKA	14	14	7	3	3	3	3	3	7	14	14A	14A
ARGENTINA	14	14	7	7	7	7	7	14	14A	21	21	21
AUSTRALIA	21	14A	14	7B	7	7	7	7	7A	14	14	14
CANAL ZONE	14	7A	7	7	7	7	7	14	21	21	21	21
ENGLAND	7	7	7	3	7	7	7B	7B	14	14	7B	7B
HAWAII	21	14A	14	7	7	7	7	3	7A	21	21A	21
INDIA	7	14	7B	7B	7B	7	7	7	7	7	7B	7B
JAPAN	21	14	7B	7	3A	3A	3	3	7	7	7B	14
MEXICO	14	7	7	7	7	7	7	7A	21	21	21	14
PHILIPPINES	21	14	7B	7B	7B	7	7	3	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	7	7	14A	21	21	21
SOUTH AFRICA	14	7	7	7	7	7B	7B	7B	14	21	21	14
U. S. S. R.	7B	7	3A	3	3A	7	7	7	7A	7B	7B	7B
EAST COAST	14	7	7	7	7	7	7	14	21	21A	21A	14

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

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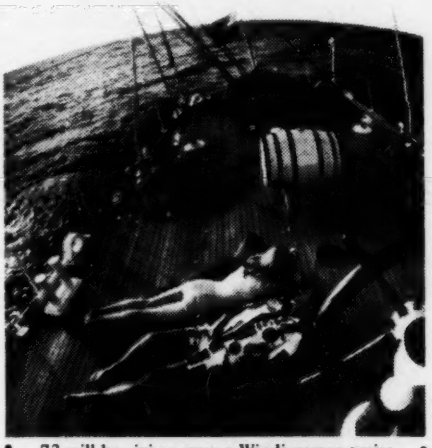

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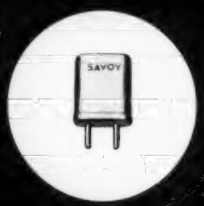

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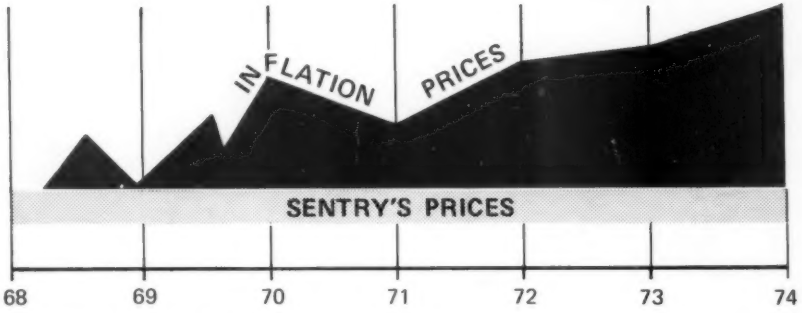

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